Vol. XIX No. 11

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AGRICULTURE, GENERAL

THE PROFESSIONAL STATUS OF EXTENSION SPECIALISTS AS COMPARED WITH RESEARCH-RESIDENT TEACHING STAFFS OF SELECTED DEPARTMENTS IN FOUR LAND-GRANT INSTITUTIONS

(L. C. Card No. Mic 59-1164)

Edgar John Boone, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Gale L. VandeBerg

Purposes

The major purpose of this study was to compare the professional status of agricultural extension specialists to that of research-teaching staffs in four state colleges of agriculture, each of which differed in type of organization for specialists. Specific objectives of the study were to determine differences, among the four organizations, in: (1) relationships between current types of organization and their early history; (2) professional status of specialists and research-teaching personnel; (3) staff members' perceptions of primary role of specialists; (4) degree of importance staff members place on certain methods for specialists to maintain their professional subject-matter competency; and (5) staff relationships existing between specialists and resident staffs.

Procedures

Louisiana, Montana, Wisconsin, and New York were the institutions included in the study. These institutions represented four types of organization for agricultural specialists, classified according to information provided by State Directors and Associate Directors of Extension. Types of organization varied from those in which specialists were closely aligned with subject matter departments to those closely aligned with extension administration. Louisiana represented the extension-aligned organization, while New York was indicative of the department-oriented organization. Between these two types of organization were several variations. Montana tended toward the Louisiana organization, while Wisconsin was closer to New York in organization.

Two hundred fifty-two persons in the four institutions were interviewed, including all staff members in Agricultural Economics, Agronomy, and Animal Husbandry, plus administrative officials of each college.

Conclusions

1. The degree to which the colleges, and specifically their subject matter departments, engaged in early extension work is still reflected in the organization and administration of specialists in these states.
2. The more closely specialists are aligned with subject matter departments, the greater is the percent of specialists having degrees comparable to those of research-teaching personnel.
3. The closer specialists are aligned with subject matter departments, the lesser the differences in academic rank accorded specialists and resident staff with comparable training, age, and tenure.
4. The closer specialists are aligned with subject matter departments, the lesser are the differences in median salaries of specialists and resident staff with comparable training, age, and tenure.
5. The closer specialists are aligned with extension, the greater is the percent having had experience as county extension agents.
6. The closer specialists are aligned with subject matter departments, the greater is the tendency for respondents to emphasize the "subject-matter consultant" role as being the primary role of specialists. Conversely, the closer specialists are aligned with extension administration, the greater the tendency for respondents to view the primary role of specialists as being that of a "trainer or teacher of agents".
7. Closer working relationships exist among staff members in the specialist-subject matter aligned organizations than in the specialist-extension aligned organization.

Recommendations

The findings support the proposition that the professional status of specialists is greater where specialists are aligned with subject matter departments. Although this type of organization for specialists is indicated as desirable, circumstances within some land-grant colleges may be such as to make this impractical. Though the type of organization often has a bearing on the status of its members, it need not be an insurmountable barrier to the improvement of status factors. While specialists are not formally attached to subject matter departments in all states, there are many measures which can be used to effect close specialist-department relationships. With these in mind, the following recommendations are made:

1. Clearly defined policies directed toward the facilitation of close specialist-department relationships need to be adopted.
2. Channels should be provided for specialists and resident staff members to have frequent interaction. Housing specialists with subject matter departments and having them participate in regular departmental staff meetings are two means for facilitating interaction.
3. Whenever feasible, subject matter activities should be planned and carried out jointly by research, extension, and teaching staff members.
4. Specialists should be on the same salary scale as teaching-research personnel, assuming comparable training, age, and tenure.
5. Advanced training to the Ph.D. level should be encouraged as a requirement for the job of the extension specialist.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

6. Specialists should be given academic rank comparable to that given subject matter associates with equivalent degrees, competency, and tenure.

Microfilm $3.20; Xerox $11.00. 246 pages.

MARKETING SHELL-LESS EGGS

(L. C. Card No. Mic 59-1194)

Dana Clement Goodrich, Jr., Ph.D.
Cornell University, 1958

A method was developed for packaging individual broken-out eggs in transparent polyethylene containers. These shell-less eggs were visible to prospective consumers and could be cooked in and eaten directly from the unbreakable packages. However, a simplified opening device was not developed until after market testing.

Tests on the holding quality of shell-less eggs indicated that: (1) there was an immediate quality loss as a result of handling during the packaging process; (2) shell-less eggs did not maintain satisfactory quality when held unrefrigerated; (3) air cells in the shell-less egg package apparently had a detrimental effect on quality retention; and (4) refrigerated shell eggs maintained quality only slightly better than refrigerated shell-less eggs. The carbon dioxide permeability of polyethylene may have limited more favorable results with shell-less eggs.

An eight-member taste panel detected no significant differences in odor and flavor between shell and shell-less eggs stored at various temperatures.

One-third of the homemakers in three upstate New York cities who sampled shell-less eggs found the packages difficult to open. Over 60 percent claimed they would buy shell-less eggs at the same price as comparable shell eggs.

Shell-less eggs were sold in three Ithaca, New York, supermarkets at two cents per dozen less than comparable shell eggs. During the initial two weeks the new product accounted for slightly over 47 percent of total egg sales in the first store. Curiosity buying probably was influential. The comparable figure for all stores during the fifth week averaged about 16 percent. A three-week pricing experiment using a latin cube design demonstrated that shell-less egg sales increased 45 percent when the new product was priced at five cents per dozen less than comparable shell eggs; at a price of five cents per dozen more than comparable shell eggs, sales were not significantly affected. Curiosity buying may have been a factor. Two pewee eggs were packaged in one shell-less egg container and marketed for one week in the three stores as "Twin Eggs". At five cents per dozen less than large grade A eggs, "Twin Eggs" accounted for over 13 percent of total egg sales.

An in-store survey revealed that over 40 percent of the customers who had tried shell-less eggs had unfavorable opinions of the product. Although many of these users objected to the inconvenience in opening the package, others were annoyed by the cooked albumen adhering to the inside of the plastic container. Although they also noted these shortcomings, consumers in the Panama Canal Zone reported that the quality of shell-less eggs generally was more satisfactory than that of shell eggs to which they were accustomed.

Although cost data for a commercial shell-less egg operation were unavailable, certain aspects of this problem were considered. The volume of eggs rejected from an operation because of internal defects probably would be greater than the volume of other undergrades (cracked eggs) useable in the process. This would offset the advantages of a possible undergrade recovery program. The value of pewee and pullet eggs probably could be increased by marketing them as "Twin Eggs" during the season of heavy production. Reduced transportation costs due to the lighter weight and more favorable weight-volume ratio of shell-less eggs and the elimination of candling costs likely would represent important savings in a shell-less egg operation.

Technologies and economies in shell-less egg production, as well as consumer preferences for the new product, are in need of further investigation.

Microfilm $2.00; Xerox $6.60. 137 pages.

DRIED ACTIVATED SEWAGE SLUDGE AS A NITROGEN SOURCE FOR RUMINANTS

(L. C. Card No. Mic 59-518)

Lonnie Ross Hackler, Ph.D.
University of Illinois, 1958

Steers and lambs were used to ascertain the value of dried activated sewage sludge as a source of supplemental nitrogen in rations for ruminants. Ruminant utilization of sewage sludge was studied using weight gains, feed conversion, nitrogen retained, biological value and digestibility as criteria. Steers and lambs were fed rations in which sewage sludge furnished up to 35 per cent of the total nitrogen. Steers in feed-lot studies were fed rations containing sewage sludge from 84 to 154 days, while lambs used in a feed-lot trial received a ration which contained sewage sludge for 56 days.

Although there were some variations in the results obtained from the feed-lot studies, it appears that the nitrogen supplied by dried activated sewage sludge was not as valuable as nitrogen furnished by soybean oil meal or by urea. Including sewage sludge in rations for lambs decreased the amount of feed consumed approximately 50 per cent. The lambs were emaciated and lost approximately 15 pounds during 56 days on the experiment. The unsatisfactory acceptance of rations containing sludge is of primary importance and imposes definite limitations on any conclusions which may be drawn from these studies. The high mineral content of sewage sludge perhaps influenced the utilization of rations supplemented with this material. Severe diarrhea present in both steers and lambs receiving sewage sludge undoubtedly influenced the utilization of sewage sludge nitrogen, although examination of the gastrointestinal tracts of sludge-fed animals did not reveal any pathological symptoms.

It appears from metabolism experiments that lambs can utilize some of the nitrogen drom dried activated sewage sludge, but not as well as the nitrogen supplied by soybean oil meal. The biological value of the protein in a ration which contained sewage sludge was equal to the biological value of the protein in a diet containing soybean oil meal and was apparently superior to the biological value of the protein in a ration which contained urea, although this

is undoubtedly a reflection of the lower level of absorbed nitrogen. The amount of total nitrogen which was retained from a ration containing sewage sludge was lower than the retention values determined for diets which contained urea or soybean oil meal. From the results of these experiments the following conclusions seem justified.

1. The acceptability of dried activated sewage sludge was unsatisfactory in rations for lambs and steers.
2. The feeding of dried activated sewage sludge reduced the weight gains of steers and resulted in loss of weight by lambs.
3. The feeding of dried activated sewage sludge produced a diarrheic condition in the steers and lambs.
4. Dried activated sewage sludge decreased the apparent digestibility of the nitrogen in rations for lambs.
5. The biological value of the protein in a ration which contained dried activated sewage sludge was equal to the biological value of the protein in a ration containing soybean oil meal and was superior to the biological value of the protein in a ration which was supplemented with urea.
6. Because of unsatisfactory acceptance of dried activated sewage sludge which reduced feed intake and because of reduced digestibility of the nitrogen, dried activated sewage sludge holds little promise as a satisfactory substitute for conventional protein sources in ruminant rations.

Microfilm $2.00; Xerox $5.60. 112 pages.

CROSS RESISTANCE INDUCTION IN THE TWO-SPOTTED MITE, TETRANYCHUS TELARIUS L.

(L. C. Card No. Mic 59-1519)

Carl Orville Hansen, Ph.D.
Cornell University, 1958

Isolated large samples of mites taken from a "non-resistant" control strain were selected with parathion, malathion, demeton, Aramite, Chlorobenzilate and Kelthane. After selection had been terminated resistance level tests revealed that the control strain had become highly resistant to the phosphates with the evidence suggesting that the transfer techniques employed (non-chemical selection) were responsible for this selection. Since the same transfer techniques were used on all of the strains it was assumed that non-chemical selection also occurred in the "selected strain". The dosage mortality data obtained in this study were analysed by the probit analysis method. Levels of resistance were determined by comparing LD_{50} values.

Demeton, malathion and Kelthane selected for a higher level of resistance than that which occurred in the control strain. Parathion, Aramite and Chlorobenzilate did not select for a higher level of resistance than occurred in the control strain. The variability between replicates of the "selected strains" was not statistically significant.

The cross resistance study, which was initiated following the completion of selection, was accomplished by determining the population response of each "selected strain" to each of the acaracides. The resulting data indicate that phosphate resistance mechanisms are linked but are not identical. Resistance to the phosphates is attributed to the selection of mites with phosphate resistance factors, which impart resistance to demeton, malathion, and parathion, but are not equally selected for by each toxicant. The broad range of resistance induced by the phosphates suggests the inclusion of resistance factors in the resistance mechanisms of the phosphates which are key sites for non-phosphate resistance.

The non-phosphates, Aramite and Chlorobenzilate, demonstrated a narrow selective spectrum by not inducing resistance to every one of the other acaracides. This suggests a difference in the mechanisms responsible for Aramite, Chlorobenzilate, and Kelthane resistance and demonstrates a difference between the phosphate resistance mechanisms.

The cross resistance data obtained in this study support the hypothesis that resistance per se in T. telarius is a complex phenomenon.

Microfilm $2.00; Xerox $4.80. 95 pages.

STUDY OF THE CONTROL OF THE PHYSICAL STRUCTURE OF PASTEURIZED PROCESS CHEESE SPREADS

(L. C. Card No. Mic 59-1402)

Norman Fredrick Olson, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Walter V. Price

Many factors influence the firmness of pasteurized process cheese spreads such as composition, emulsifying salts, methods of processing, heat treatments, homogenization and storage conditions.

This study has been limited to the effect on firmness of spreads caused by modification of composition, heat treatments, homogenization and the control of the hydrogen ion concentration of spreads.

Effects of composition were determined by varying the percentage of moisture and the percentage of fat of a basic control spread. The control spread contained 52.3% moisture, 20.6% fat and 27.1% solids-not-fat. The protein portion of the solids-not-fat in this control spread was supplied solely by the cheese, dariworld.

Variation in the moisture content of spreads when the same proportion of solids-not-fat (SNF) to fat was maintained caused significant changes in spread firmness measured by penetrometer. Variation in the fat content when the same proportion of moisture to solids-not-fat was maintained caused no significant changes in spread firmness.

A definite relationship was established between moisture/SNF and penetrometer values of spreads with variable fat and moisture contents.

Replacement of cheese-solids-not-fat (cheese-snf) of spreads with nonfat dry milk (NDM) or lactose produced spreads that did not follow the established trends of moisture/SNF and penetrometer value relationship. The penetrometer values increased in direct proportion to the amount of cheese-snf that was replaced. This established the necessity of using moisture/cheese-snf to predict spread firmness.

This ratio accurately predicted the firmness of spreads containing 3.0% lactose as well as that of the spreads that varied in moisture and fat. It was also applied successfully

in predicting the firmness of spreads containing 3.0 and 6.0% NDM when it was modified by adjusting it to compensate for the lactose in NDM solids.

The firmness of spreads containing NDM or lactose increased markedly during storage at 90°F. but not at 70°F. The firmness was apparently caused by production of acid by Gram-positive, aerobic-to-facultative, spore-forming bacilli. Spreads containing no added NDM or lactose did not increase in firmness nor did they contain large numbers of bacilli even when stored at 90°F.

Heating the spreads to 170 or 190°F. during processing produced softer spreads than a heat treatment of 150°F. After a short storage period, spreads processed at the lower temperatures showed significant increases in firmness and decreases in pH; they also contained large numbers of cocci and bacilli.

Spreads homogenized at 500 p.s.i. were softer than those homogenized at 1500 or 2500 p.s.i.

Rapid heating to the processing temperature of 185°F. produced softer spreads than slow methods of heating. Extending the duration of holding time at the processing temperature from 1 to 5 minutes and modification of the rate of cooling did not cause significant changes in the firmness of the spreads.

The type of acid added to spreads to adjust the hydrogen ion concentration did not affect spread firmness but the pH attained was the critical factor which determined the firmness of spreads.

A postulation to explain the probable physical structure of pasteurized cheese spread was developed by the experimental evidence of this study. The basic structure is believed to consist of an emulsion of fat that is stabilized by dispersed protein of the cheese and nonfat dry milk. The protein-covered fat may remain partially dispersed to give the rheological properties of a colloidal sol or the adsorption layers surrounding the globules may cohere to form a system of aggregates possessing the rheological properties of a gel at room temperature. The water phase of the colloidal system is a critical factor in determining viscosity or plasticity because it affects the structural density of the aggregates.

Microfilm $2.00; Xerox $6.60. 145 pages.

AN ANALYSIS OF CERTAIN PERSONNEL POLICIES OF THE COOPERATIVE EXTENSION SERVICE WITH EMPHASIS ON OREGON

(L. C. Card No. Mic 59-1413)

Clifford Lovejoy Smith, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Robert C. Clark

Purpose and Procedure

The principle purpose of this study was to analyze and evaluate personnel policies and procedures of the Cooperative Extension Service with emphasis on Oregon. Certain national data and research findings from other states are also included.

Personnel policies and procedures included in the study were: employment practices; in-service and graduate training; salary, rank, tenure, leave, and other benefits; job performance evaluation; and job descriptions.

Interviews were conducted with forty-nine Extension and Resident staff members of Oregon State College. Additional data were obtained from interviews with Louisiana Extension personnel, and from analyzing Extension records, bulletins, research reports, workshop proceedings, and other publications.

Objectives and criteria for evaluation of personnel policies of the Extension Service were identified. The objectives and summary of criteria follow:

1. To employ persons who have necessary qualifications to adequately fill the positions for which they are selected, and who have the potential to assume additional responsibilities in the organization. Analysis and evaluation was based on the specific recruitment and selection methods that were used.
2. To develop and implement, or otherwise make available, an in-service training program that increases staff efficiency and job satisfaction. Evaluation was based on the extent to which training programs recognized individual needs and provided for trainee participation.
3. To provide opportunity and encouragement for members of the Extension staff to develop greater professional competence through making graduate training available. Progress toward this objective was measured by the availability of study leave privilege, financial incentives, and active encouragement by Extension administration.
4. To establish salary, professional rank, tenure, leave, retirement, and insurance policies and practices that will attract and retain staff members who are fully qualified to fulfill the purposes of the organization. Criteria for evaluation were: comparative salary levels, compensation for superior performance, and privileges and benefits that are comparable with those offered in other divisions of the Land-Grand institution.
5. To provide systematic and equitable evaluation of the job performance of each staff member. Evaluation criteria were: availability of job descriptions, provision for self-evaluation, and supervisor-employee counseling that emphasizes training needs.

Conclusions

1. The information suggests that relatively more care is exercized in the selection and placement than in the recruitment of Extension personnel.
2. In-service training programs for Oregon Extension personnel generally recognize individual needs and provide for trainee participation in the planning and conducting of training activities.
3. Orientation of new Extension workers in the counties is not adequate in all cases.
4. Job descriptions appear to be useful in planning and developing an in-service training program.
5. Extension personnel at all levels recognize the increasing importance of improving their professional competence through graduate training.
6. Participation in Extension summer sessions is considerably less than Extension leaders consider desirable

and has shown no significant increase nationally, or in Oregon, in recent years.

7. The average salaries of county Extension personnel in Oregon rank near the top for the United States, but Extension salaries in the State are somewhat below salaries for Resident Instruction and Experiment Station staffs.

8. Extension personnel in Oregon are afforded the same academic titles, tenure, sabbatical, annual and sick leave privileges as staff members in other divisions of the College.

9. A personnel evaluation plan that is based on job performance appears to be the most suitable for the Cooperative Extension Service. Job descriptions and plans-of-work provide essential information for performance evaluation.

Recommendations

1. Extension recruitment programs should start in the counties with pre-college prospects and should actively involve the college instructional staff.

2. The Extension Service should outline the necessary qualifications of personnel for the various positions in the organization.

3. Long range in-service and graduate training objectives should be developed and implemented.

4. Job performance evaluation should include provision for self-rating and mutual supervisor-employee effort in implementing plans for professional improvement.

Microfilm $3.05; Xerox $10.40. 233 pages.

FACTORS ASSOCIATED WITH THE USE OF MILK AS A BEVERAGE BY ADULTS

(L. C. Card No. Mic 59-779)

Daniel Augustus Swope, Ph.D.
The Pennsylvania State University, 1958

As a basic step in promotional programs to increase the demand for fluid milk, this study was designed to delineate the factors associated with milk drinking by adults. Milk producers have sought increased returns through greater sales of fluid milk. Furthermore, nutritional studies have indicated that increased milk consumption would aid in correcting the calcium deficiency in the diets of many adults.

Hypotheses to be tested emphasized concepts and definitions of milk that served as appeals, as well as those that served as obstacles to milk drinking. The analysis involved testing hypotheses for differences between 1) drinkers and non-drinkers of milk, and 2) regular and occasional drinkers. "Regular drinkers" were those who reported drinking milk 7 or more times per week; and "occasional drinkers," 1 to 6 times per week.

Data were collected in a probability sample of 1,393 adults in Williamsport, Pennsylvania, Spring 1956. Qualified respondents were persons at least 18 years of age, and out of high school, and who ate at least half their meals at home.

In the total sample, 31 per cent of the adults were regular drinkers; 21 per cent, occasional drinkers; and 48 per cent, non-drinkers. Milk drinking frequency was based upon a beverage pattern obtained at the outset of the interview, listing all beverages used in a typical week, by meal and time of day.

By characteristics of the population, milk drinking was practiced by more of the men than the women; more of the younger than older adults; and by more of the men in households with children than in those composed of adults only.

Whereas a liking for milk was its foremost appeal to those who drank it, a dislike for the taste was the major obstacle to its use among non-drinkers. Taste acceptance seemed to be established by regular milk drinking in childhood and was reinforced by continuation of the habit.

Health and nutritional appeals to milk drinking were more evident among female than male drinkers. Women seemed to have greater nutritional knowledge and were more likely than men to consider milk drinking necessary for adults.

Although a large proportion of the respondents considered milk nutritionally important, and believed milk drinking was necessary for adults, many of these did not drink it, apparently because they valued beverages more for their taste appeal than their nutritional importance. Thus, coffee appeared to be the preferred beverage among non-drinkers. The idea of drinking both coffee and milk at a meal was generally disfavored.

Whereas coffee was generally considered an appropriate beverage to be served to guests within the home, and to be selected in situations outside the home, the concept of milk as an inappropriate beverage was more prevalent among non-drinkers than drinkers.

Milk drinking was more prevalent among younger than older adults, largely because younger persons were: 1) more likely to have used milk regularly in childhood; 2) less likely to start coffee drinking during their early years; 3) better educated, and had greater nutritional knowledge; and 4) more likely to consider milk an appropriate beverage. Thus, it appears that milk has become more accepted in the food habits of our culture in recent years. This has been motivated by greater nutritional knowledge, facilitated by improved technology, and reinforced by the expanded practice of milk drinking by persons in all age groups.

Greater taste acceptance was the major factor differentiating between regular and occasional milk drinkers. Also, the image of milk as a beverage used by healthy, robust persons seemed to invite greater use.

Other limitations to milk drinking among occasional drinkers included: 1) the competition of coffee; 2) limited availability of milk at the place of work; and particularly for men, 3) the definition of milk as a beverage used by children only. Microfilm $2.00; Xerox $8.60. 190 pages.

AGRICULTURE, ANIMAL CULTURE

AN EVALUATION OF CHROMIC OXIDE AS AN INDICATOR FOR DETERMINING DIGESTIBILITY OF BEEF CATTLE RATIONS

(L. C. Card No. Mic 59-480)

Neil Wright Bradley, Ph.D.
University of Illinois, 1958

An evaluation of the chromic oxide indicator method of determining digestibility of a complete pelleted ration by beef cattle was undertaken. Chromic oxide excretion patterns were determined for steers which received either a limited or a full feed of a ration containing chromic oxide as well as for steers receiving chromic oxide capsules. Digestion coefficients for protein and energy were determined by total collection and compared with those determined by the chromic oxide method in metabolism stalls and in the feed lot.

Excretion patterns resulting from administering chromic oxide in (a) capsule form and (b) mixed in the feed were established by taking fecal samples at 2-hour intervals for 2-day periods in a single reversal type experiment. A large amount of variation was found in the chromic oxide concentration of individual fecal samples. However, the general shape of the two average excretion patterns was similar. The average chromic oxide concentration from 6 A.M. to 10 A.M. for capsule administration and at 8 A.M. and 10 A.M. for feed administration was reasonably close to 100 per cent of the mean fecal chromic oxide concentration. A low chromic oxide concentration during the day and a high concentration at night was more pronounced when the indicator was given in capsules. Optimum sampling plans appeared to be to composite samples taken at 6 and 10 A.M. for capsule administration and at 8 and 10 A.M. when chromic oxide was mixed in the feed.

When a complete pelleted ration containing chromic oxide was fed in metabolism stalls, digestion coefficients calculated from composited 8 and 10 A.M. grab samples were not significantly different from coefficients determined by the total collection method. However, digestion coefficients calculated from 8 and 10 A.M. composited samples taken from steers fed the same ration at the same level of intake under feed-lot conditions were significantly lower than those determined by total collection. Variation between steers was larger in the feed lot. A possible change in fecal chromic oxide concentration due to the steers in the feed lot eating some of the wood shavings which were used for bedding was considered.

The average chromic oxide excretion pattern was determined for four steers which were fed feed, containing chromic oxide, three or more times per day at their maximum intake under feed-lot conditions. The greater feed intake or the more frequent feedings did not reduce the large amount of variability in the chromic oxide concentration of individual samples. The best time to sample feces according to the full-feed excretion curve was at 8 P.M. or 10 P.M. or to composite samples taken at both of these times. This is exactly 12 hours later than the sampling times found to be best for steers which were fed a limited feed once in metabolism stalls.

The following conclusions may be drawn from the results of this chromic oxide indicator study.

1. The excretion rate of chromic oxide at various times of day is sufficiently variable to prevent random sampling of feces for determining digestibility.

2. The average chromic oxide excretion patterns were similar when chromic oxide was administered by capsule or in the feed. However, more variability occurred when chromic oxide was administered in capsule form.

3. An adequate sampling plan appears to be most critical in the chromic oxide method, and apparently must be determined under the exact conditions of each experiment because of variation in the excretion rate of chromic oxide.

4. Under the conditions of this experiment, feeding chromic oxide containing feed frequently throughout the day and at the maximum intake of steers did not reduce the variability in the excretion rate of chromic oxide.

Microfilm $2.00; Xerox $4.40. 81 pages.

STUDIES ON THE UTILIZATION OF INGESTED LIPIDS BY RUMINANT ANIMALS

(L. C. Card No. Mic 59-334)

Robert Lee Edwards, Ph.D.
North Carolina State College, 1958

Supervisor: Elliott Roy Barrick

A study has been made of the manner in which ruminant animals utilize dietary lipids. It was found that hydrolyzed cottonseed fat and yellow animal grease were satisfactory energy sources for fattening steers in amounts up to at least 5 per cent of the total ration. Animal grease was found to be highly digestible in sheep rations, but palatability was a problem.

No evidence was found that dietary animal fat adversely affected carcass quality in dry-lot steers. Rind thickness was increased by feeding animal fat, and the percentage of separable fat in the rib section was also increased in those steers previously on a low-energy ration.

Samples of rib fat from steers fed animal grease in dry-lot and on pasture were analyzed for fatty acid composition by means of gas chromatography. Myristic, myristoleic, palmitic, palmitoleic, stearic, oleic, linoleic and linolenic acids were found, along with four unidentified substances.

Dry-lot steers fed animal grease deposited a higher percentage of saturated fatty acids, particularly stearic acid, than control animals. This effect was more pronounced in animals previously receiving a low-energy ration. The steers receiving the added-fat rations deposited a lower percentage of linoleic acid, and a lower percentage of an unidentified acid.

Pasture-fed steers receiving a grain supplement with added animal fat deposited a higher percentage of myristic acid than steers not receiving the additional fat. A lower percentage of oleic acid was deposited when the animals had been implanted with diethylstilbestrol. This hormone depressed the deposition of palmitic acid in the steers receiving dietary animal fat, and stimulated such deposition in steers not on the high-fat ration; an opposite effect was noted on the deposition of palmitoleic acid. The values for percentage of palmitoleic acid in depot fat of the pasture-fed steers were very high in comparison with those found in dry-lot steers, and in comparison with published values.

Bovine rumen contents were found to possess lipolytic activity, which increased when a ration containing 3 per cent added animal fat was fed.

Microfilm $2.00; Xerox $5.80. 117 pages.

AN ANALYSIS OF THE GENETIC AND ENVIRONMENTAL FACTORS AFFECTING LARVAL DEVELOPMENT OF QUEEN HONEY BEES

(L. C. Card No. Mic 59-1395)

Roger Allen Hoopingarner, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor C. L. Farrar

The phenotypic differences between queens are caused by genetic and environmental factors. In these experiments the differences were measured by weight analysis of the queen pupae.

Control of the genetic factors was obtained by using inbred lines of honey bees. Weight differences between various inbred lines were highly significant. Highly significant differences between two inbred lines and their reciprocal F_1 hybrids indicates heterosis for body weight in queen honey bees. These differences in weight were compared with the number of ovarian tubules in the queen pupae. Counts of the ovarian tubules in stained, cross sectioned, abdomens gave a highly significant positive correlation and regression of ovarian tubules on body weight.

Genetic differences in various strains of honey bees had confounded analysis of queen rearing methods. With control over the genetic factors three queen rearing systems were compared for (1) production of queens, (2) maximum size for the genotype of the queen, and (3) minimum variability between queens. One system or colony organization (designated in these experiments as the sealed-brood colony) was shown to be superior to the standard type and to a third type of queen rearing colony. This superiority was shown in equal or slightly greater size of the queens, reduced variability, and rearing of a larger number of queens.

Microfilm $2.00; Xerox $3.80. 67 pages.

RELATIONSHIP OF FREQUENCY OF FEEDING TO FEED UTILIZATION AND OTHER PHYSIOLOGICAL ACTIVITIES OF THE BOVINE

(L. C. Card No. Mic 59-343)

Richard Douglas Mochrie, Ph.D.
North Carolina State College, 1958

Supervisor: Henry Laurence Lucas, Jr.

Increasing the frequency of feeding of equalized daily intakes was demonstrated to enhance weight gains of growing dairy cattle under certain conditions. Feeding a concentrate-hay ration 4X, compared with 1X, increased weight gains by 59%, 49% and 18% in three studies. Feeding the ration 4X or feeding hay 1X and concentrate 4X in a fourth study resulted in weight gains and increases in height at withers that were not significantly different from those for animals fed 1X. Feeding a concentrate-hay ration in two, four or eight portions failed to affect the milk and fat productions or the weight changes of lactating animals. Since no single factor appeared to account for the difference in magnitude of the responses between the trials, a response to frequency of feeding appears to be dependent on a favorable balance of two or more factors.

In metabolism studies the apparent digestion of cellulose and gross energy were significantly depressed by increased frequency of feeding. Diurnal variations in rumen activity were less pronounced for feeding 4X than for 1X as evidenced by values at 3-hour intervals for rumen cellulolytic activity, pH and volatile fatty acids (VFA). Diurnal variations in VFA concentrations in arterial and venous blood were also less pronounced. Ratios of individual rumen VFA did not appear to be affected by feeding frequency.

Simultaneous consideration of rumen and blood VFA values, pulse rate and live weight changes indicated that, compared with animals on single feeding, animals fed frequently absorbed about the same amount of VFA, had a higher metabolism over most of the day and metabolized a greater quantity of nutrients other than VFA. Possible mechanisms whereby a greater quantity of nutrients could be absorbed despite a decreased apparent digestibility were pointed out. Various mechanisms which have been suggested in the literature were discussed in the light of the results obtained. Suggestions for additional work on the mechanism of the response and on factors which may alter it were presented.

Microfilm $2.00; Xerox $5.80. 119 pages.

THE EFFECT OF LIGHT, FLOOR SPACE, AND FORM OF FEED UPON CANNIBALISM, BODY WEIGHTS, FEED CONVERSION AND MORTALITY IN BROILERS

(L. C. Card No. Mic 59-773)

Winthrop Charles Skoglund, Ph.D.
The Pennsylvania State University, 1958

One of the problems which has plagued the poultry industry throughout the years has been that of cannibalism, manifested by feather picking on the back of the chicken. The resulting bare-backed broilers bring a lower price on the market causing a serious loss in income for the broiler grower. The actual causes of cannibalism are still undetermined, but theories have been advanced that light intensity may play an important role.

This study was initiated primarily to determine whether light intensity or length of light period are causative factors in producing cannibalism and also to determine whether combining various light intensities with form of feed and/or floor space allotment results in an interaction which might also cause cannibalism. Characteristics such as body weight, feed conversion, mortality rate, and uniformity of weights were also studied.

The pens were darkened and reflector type floodlights were used to give light intensities of 15, 60, and 120 foot candles at the height of the feeder. In addition, light duration periods of 12 and 24 hours were used. Broiler type

stock was used and at 10 weeks of age they were individually weighed and the feathering on the back scored on the basis of one for complete feathering, two for 1/4 to 1/2 of the feathers missing, three for 1/2 to 3/4 missing, and four for a complete bare-backed bird. In addition, feed conversion and mortality records were also obtained. Three trials with three replicates for each treatment were used in this phase of the work. There was no evidence of feather picking in any of the trials indicating that the light intensities and the lengths of light duration studied had no effect upon the incidence of cannibalism.

Based on the results mentioned above, a second series of experiments were established in which the two extremes of light intensity were compared and combined with two feed forms, mash and pellets; and two floor space allotments, 1 square foot and 2/3 square foot; in order to study any interaction effect. Three trials with two replicates for each treatment were used in this phase of the work. Once again it was demonstrated that light intensity itself had no effect upon feather picking, but the birds fed pellets or allotted 2/3 square foot of floor space per bird were subject to increased feather picking. The combination of a light intensity of 120 foot candles, pelleted feed, and a floor space allotment of 2/3 square foot per bird appeared to produce a slightly increased amount of feather picking, but the interaction was not significant. The 15 foot candle groups on the average showed a heavier body weight than did the corresponding groups with 120 foot candles, but this difference was not consistent for all rations and trials. The use of pelleted feed rather than mash resulted in greater body weights and statistically significantly superior feed conversion.

Neither feed form, space allotment, nor light intensity had any significant effect upon mortality rate or uniformity of body weight as measured by coefficient of variability.

Microfilm $2.00; Xerox $4.20. 77 pages.

AGRICULTURE, FORESTRY AND WILDLIFE

INVESTIGATIONS OF THE AMERICAN WOODCOCK IN MICHIGAN

(L. C. Card No. Mic 58-7117)

Lytle Houston Blankenship, Ph.D.
Michigan State University, 1957

Investigations of the American woodcock in Michigan were made for the purpose of developing and improving management techniques involving the bird. Phases especially investigated were (1) migratory habits, annual production, and population levels, (2) extent of present utilization of the resource, and (3) factors influencing the distribution, abundance, and activities of the bird.

Woodcock arrived in Michigan during late winter. By the last of April, spring migration was completed. Movements thereafter were restricted to local activities until late summer when fall migration began. Most woodcock moved through Regions I and II by October 20 while in Region III some birds had moved out and others moved in by that date.

The major part of the breeding season occurred between April 15 and May 15 in the Lower Peninsula and between April 25 and May 25 in the Upper Peninsula. Singing-ground counts were made during these periods. Data obtained on these counts were used to determine factors affecting observations and woodcock activity, population trends, number of times a route should be run, and number of routes to be run in the state.

Woodcock breeding activity was affected by light intensities, rain, temperature, wind, and other animals, particularly man. Major factors affecting observations were wind and noise interference.

Singing-ground routes usually were run two or three times each but a statistical analysis of data from one route indicated that the route would need to be run at least 27 times to obtain confidence limits 25 per cent of the observed mean. Economically, a route should be run twice the first year and once each year thereafter.

A comparison of bill lengths and the total width of the outer three primaries was considered a reliable criterion of sex. A comparison of the total width and total length of the same primaries was used also for sexing birds. Leg color was used tentatively as a criterion of age.

Sex and age data in conjunction with nesting success, brood sizes, and kill figures were used to determine survival and mortality and to analyze the extent of harvest. Data indicated woodcock are not being over-harvested in Michigan.

Major factors influencing the distribution, abundance, and activities of woodcock were vegetation, food, weather, and soil. Minor factors included competition, predation, diseases and parasites, and accidents.

Vegetation was important in restricting distribution as well as serving as an indicator of the habitat type. The availability of earthworms was a critical factor determining whether or not woodcock used certain areas as feeding or loafing sites. Weather, including temperature, wind, and precipitation, influenced local activity and migration. The remaining factors were of little importance except in local situations.

For managing the woodcock population two methods seemed promising. First, improvement of habitat by vegetation controls should be used on singing grounds and feeding areas. Second, a change in hunting season dates to correspond more closely to migratory movements might be helpful for increasing the harvest of woodcock.

Future studies should emphasize the relationship between woodcock populations and habitat changes, practical methods for determining seasonal occurrence of birds, increased vegetation control by various means, and better techniques for determining population trends. In the meantime, banding operations and singing-ground counts should be continued and increased when possible.

Microfilm $3.15; Xerox $10.80. 244 pages.

AGRICULTURE, PLANT CULTURE

THE CHARACTER AND GENESIS OF A CLAY-ENRICHED HORIZON THAT OCCURS BELOW THE NORMAL B_2 HORIZON AND IN COARSE TO MEDIUM TEXTURED DRIFT OF WISCONSIN AGE

(L. C. Card No. Mic 59-470)

Lindo Joseph Bartelli, Ph.D.
University of Illinois, 1958

The normal Gray-Brown Podzolic and Brunizem soils of northeastern Illinois, that are developed in part from calcareous, coarse to medium textured glacial drift, are characterized by a second zone of clay enrichment (designated herein as a Beta horizon) which is found directly above the contact of leached soil material and calcareous drift and below the normal B_2 horizon. The objectives of this study were (a) to characterize the morphology and field relationships of the Beta horizon, and (b) through chemical, physical, micromorphological and sand column studies to more precisely define the properties of this layer and to clarify the genesis of it.

Field studies indicated that this horizon occurs below the normal B_2 horizon and immediately above a calcareous layer. It can be recognized by its somewhat darker color than the B_2 horizon immediately above. Studies of toposequence relationships showed that the Beta horizon was most pronounced in the well-drained member and absent in the poorly-drained member of the catena. Close correlation was also noted between the degree of development and drift texture; the Beta horizon was most pronounced in coarser textured drift and became less distinct as the texture of the drift became finer. It was also found that this horizon was more strongly developed in the Gray-Brown Podzolic soils than in the associated Brunizems.

Microscopic investigations indicated the peds of this horizon were microconstructional. The ped structure is a result of not only the arrangement of skeletal material in situ, but also the effect of colloidal material which has moved into the horizon from above and deposited on surfaces of grains, peds, and walls of pores to alter the original microconfiguration and porosity.

Petrographic studies of thin sections showed a rather porous fabric, which is characterized by a large percentage of the clay being strongly orientated in layers along surfaces of peds, mineral grains, walls of pores, and root channels. This fabric is interpreted to be strongly indicative of clay migration. Thin sections of sand columns through which clay suspensions were passed showed a marked similarity between the fabric of the sand columns and the natural Beta horizons studied.

Clay migration appears to be the dominant process responsible for the development of the Beta horizon. This was substantiated by an examination of the clay mineralogy and the particle-size distribution of the clay separate. The translocation of clay is probably controlled by both physical and chemical processes. The location of the Beta horizon in the zone of contact between coarse textured, rapidly permeable substrata and finer textured, less permeable subsoils is probably related to the discontinuity in moisture flow at this boundary. It is probable that the flow of water through the soil is arrested at this boundary for long periods of time because of differential moisture tension. Furthermore, the precipitation of colloidal material would probably be enhanced by the flocculating and demobilizing effect of the high calcium ion concentration that exists in the Beta horizon.

It was concluded that the Beta horizon forms an important part of the soils studied and it should be recognized as an integral part of these soil series.

Microfilm $2.00; Xerox $6.40. 135 pages.

THE EFFECTS OF PREVIOUS CROPS ON GROWTH, YIELD, AND CERTAIN CHEMICAL CONSTITUENTS OF TWO SOYBEAN VARIETIES

(L. C. Card No. Mic 59-1260)

Prasanta Kumar Dutta, Ph.D.
University of Minnesota, 1958

Advisers: Thor Kommedahl and A. J. Linck

The preceding crop is one factor that affects crops that follow. Most research has been directed towards the effect of one crop on plant growth, seed quality, and yield of the succeeding crop. Studies were made to determine the effect of five preceding crops on growth, protein, oil content and yield of two soybean varieties, Ottawa Mandarin and Renville.

The field studies were made in a permanent crop sequence plot at the Agricultural Experiment Station, Rosemount. Included in this sequence were corn, oats, wheat, flax and soybeans. Field studies were made during the summers of 1956 and 1957.

Significant differences in plant height were observed in 1956 for varieties Ottawa Mandarin and Renville. Soybeans after oats were the tallest and those after flax were the shortest. In 1957 there was no significant difference in height at maturity for either variety.

The total plant dry weight of soybean variety Ottawa Mandarin and Renville was higher after oats and lower after flax in 1956, but not in 1957. For both years, the variety Renville had the least total dry weight when grown after flax. The variety Ottawa Mandarin did not show any significant difference in dry weight of roots from any of the treatments either in 1956 or in 1957.

Application of different crop residues failed to show any effect either on stand or on dry weight of soybean seedlings in a greenhouse experiment. Leachates from five different crop-soils produced a significant difference in plant height but did not affect the number of pods per plant or seed weight.

During 1957, the severity of brown spot disease caused by Septoria glycines Hemmi, was more than three times as severe on plants of soybeans after soybeans, than soybeans after four other crops. This was true for both varieties.

Different preceding crops did not produce any significant effect either on protein or on oil content of beans of both varieties during both years.

Bulk density and water-stable aggregate content of the five different crop soils were not significantly affected by any of the preceding crops both in 1956 and 1957.

The conclusion reached from this work is that a preceding crop of corn, oats, wheat, flax or soybeans had no

marked effect on a crop of soybeans for the two years of test, based on measurements of seed and hay yields, protein and oil content of seed, date of flowering, pod number, leaf area, plant height and root weight. However these tests were based on plots of high fertility. If these measurements provide sufficient criteria for the influence of a preceding crop on soybeans, it is possible that soybeans would yield equally well in any rotation involving these five crops if fertility were maintained.

Microfilm $2.00; Xerox $3.00. 57 pages.

STUDIES ON CERTAIN ECOLOGICAL FACTORS AFFECTING THE BIOLOGY OF THE LESION NEMATODE

(L. C. Card No. Mic 59-335)

Burton Yoshiaki Endo, Ph.D.
North Carolina State College, 1958

Supervisor: Joseph Neal Sasser

A study was made of the influence of certain ecological factors on the development and survival of two of the important lesion nematode species in the Southeastern United States, Pratylenchus brachyurus (Godfrey, 1929) Filipjev and Stekhoven, 1941 and P. zeae Graham, 1951. The objectives were to study 1) the relative susceptibility or resistance of important crop plants grown in the southern states to two widespread species of the lesion nematodes, 2) the influence of host nutrition and light intensity on lesion nematode infection and reproduction, 3) the effect of soil type and microorganisms in the soil on lesion nematode development and survival, 4) the effects of soil types on lesion nematode migration in the soil with and without host plants, and 5) the occurrences of lesion nematode species in North Carolina.

Of the 33 plant species and varieties tested as to relative susceptibility to Pratylenchus zeae, 4 were classified as very favorable, 6 favorable, and 23 not favorable. Out of 30 plant species and varieties tested as to relative susceptibility to P. brachyurus, none were classified as very favorable, 9 favorable, and 21 as not favorable. Reproduction of P. brachyurus on host plants over a period of 4 months indicate that very high populations can be obtained on corn and peanut plants, whereas very low populations were associated with oats and crotalaria.

Physiological changes in plants induced by light intensity and nitrogen nutrition treatments were not sufficient to appreciably alter the nematode infection and reproduction in plants when based on a unit weight of roots. When nematode populations were based on whole root systems, significant differences were noted. Larger numbers of nematodes were associated with heavier root systems.

Norfolk sandy loam soil was found to be the most favorable soil type for the infection and reproduction of lesion nematodes on suitable host plants. This relationship existed for Pratylenchus brachyurus on strawberry and cotton plants on a unit root weight basis as well as on a whole root system basis. Cecil clay loam soil was the least suitable soil for the infection and reproduction of the lesion nematode. Portsmouth loam soil was intermediate in suitability to nematode infection and reproduction.

Lesion nematode migration was influenced by soil type and the presence of a suitable host plant. Maximum nematode migration occurred in the Norfolk sandy loam soil that was planted with corn. Shortest distance of migration was in the Cecil clay soils, whereas intermediate distance was noted for the Portsmouth loam soil. In the absence of host plants, little or no migration occurred in any of the soil types.

Four species of lesion nematodes associated with various crops were identified from North Carolina. These included Pratylenchus brachyurus, P. penetrans, P. scribneri and P. zeae.

Microfilm $2.00; Xerox $4.20. 77 pages.

INDUCTION OF FLOWERING IN THE SWEET POTATO (IPOMOEA BATATAS LAM.)

(L. C. Card No. Mic 58-5445)

Shue Lock Lam, Ph.D.
University of Illinois, 1958

The improvement of sweet potatoes by plant breeding has been seriously handicapped by the non-flowering habit of many varieties. The objectives of this study were to establish the existence of the causal factor responsible for flower initiation and development in the sweet potato and its relationship to external conditions.

A method of grafting the sweet potato on related species of morning glory was developed to induce the sweet potato to flower. The results indicate that a flowering substance is synthesized in leaves of the morning glory donor and is then translocated to meristematic tissue of scions of the sweet potato where it exerts its morphogenetic effect. The level of the flowering substance appears to vary with different donor species and is greatly influenced by external environmental conditions.

Movement of the flowering substance through the plant was shown to be non-polar, and could even be translocated through inverted tissues. The presence of leaves on the receptor did not reduce the effect of the flowering substance from the donor. It appeared that the flowering substance was not destroyed by light, and it can not be considered to be self-perpetuating as has been observed in Xanthium.

Most species of morning glory are sensitive to short photoperiod. However, certain species will bloom profusely even under continuous light if grown at temperatures below 75° F. This indicates that temperature can substitute for the photoperiodic requirement, and the dark period seems to be unnecessary so far as floral initiation and development is concerned. At high temperatures (86°-105° F.), a short photoperiod is essential for flowering of the morning glory. Therefore, exposure of the donor to a short photoperiod is essential to obtain floral induction in the sweet potato at high temperatures. The photoperiodic effect was demonstrated to be additive.

Wide differences among different species were observed with respect to effectiveness of inducing the sweet potato to flower. Some species were very effective during the summer but of no value in the fall and winter and even produced an inhibitory effect on the growth of the sweet potato scion.

The percentage of successful grafts varied considerably with different graft combinations at different seasons of the year. This variation seems to be related in some way with the flowering behavior of the donor.

Microscopic study of floral initiation and development of the sweet potato indicates that axillary bud primordia could be converted into floral primordia from five to eight days after grafting. However, once axillary bud primordia have developed to the stage of the youngest dissectible vegetative bud primordia, they can not be converted into floral primordia.

By selecting the appropriate morning glory species, and adjusting the temperature and photoperiod, the plant breeder should be able to induce any variety of sweet potato to flower during any season of the year. With knowledge of the number of days required for the opening of the first flower after grafting, the flowering time of the sweet potato can also be predicted.

Microfilm $2.00; Xerox $4.60. 89 pages.

NITROGEN MOVEMENT AND TRANSFORMATIONS IN SOILS AS EVALUATED BY A LYSIMETER STUDY UTILIZING ISOTOPIC NITROGEN AND A FIELD STUDY

(L. C. Card No. Mic 59-555)

Lowell Davis Owens, Ph.D.
University of Illinois, 1958

A lysimeter experiment was conducted to determine the fate of nitrogen applied to soils several months prior to cropping. Ammonium sulfate labeled with nitrogen-isotope 15 was applied to soils at the rate of 120 lbs. N/acre during each winter of the 2 years the experiment was conducted. During the period between nitrogen application and crop seeding, 3 moisture rates, 12-13, 18, and 24 inches, were established on the soils. Both total and labeled nitrogen were measured in the leachates, crops, and soils at the close of the experiment. From these data a nitrogen balance sheet was constructed. The portion of the fertilizer nitrogen unaccounted for at the end of 2 years was assumed to have been denitrified. The conclusions are:

(1) Losses of winter-applied nitrogen through leaching were directly proportional to the amount of moisture applied to the soil surface and/or the amount moving through the soil profile.

(2) Crop recovery of added nitrogen was inversely proportional to the spring moisture rates. Losses of fertilizer nitrogen through leaching occurred almost wholly at the expense of crop uptake.

(3) The amount of fertilizer nitrogen remaining in the soil at the close of the experiment was not affected by the moisture treatment.

(4) An average of 33% of the nitrogen applied to the soils was denitrified. The standard deviation associated with this mean was 6%.

(5) Moisture rates during the several months between nitrogen application and crop seeding had no effect on the extent of denitrification losses. Three possible explanations are offered.

(6) Experimental conditions were conducive to both leaching and denitrification, thus the losses observed can be expected to be maximal.

Two field experiments were conducted on a silt loam soil to compare the effectiveness of different forms of nitrogen when applied in the winter. Ammonium sulfate, sodium or calcium nitrate, and urea were applied at the rates of 0, 60, 120, and 240 lbs. N/acre. Three moisture rates ranging from 9.4 to 29.2 inches were established the first year during the 5 months between fertilizer application and crop seeding. Four forage crops were grown successively on the plots over a period of 2 years to provide information on both the immediate and residual treatment effects. The amount of nitrogen removed by the crops was considered to be indicative of the relative nitrogen losses occurring from the various forms tested. The conclusions drawn from these 2 field experiments are:

(1) Nitrogen losses were proportional to the amount of moisture applied to the plots during the period between nitrogen application and crop seeding. This was true even where no fertilizer nitrogen was applied.

(2) Nitrogen losses were greatest from plots receiving nitrate and least from those receiving ammonium forms of nitrogen. Losses from urea-treated plots were generally intermediate.

(3) An interaction occurred between moisture rates, nitrogen rates, and nitrogen forms. Nitrogen recoveries from nitrate and ammonium forms were similar at low nitrogen rates and low moisture levels, but less nitrate was recovered as the applications of either nitrogen or moisture were increased.

(4) Because of certain climatic conditions, residual nitrogen effects on crop yield and nitrogen uptake were relatively large during the second year after application in experiment I. Residual effects in the second experiment were relatively small.

(5) Since the experimental conditions were especially favorable to leaching and denitrification, the nitrogen losses indirectly measured can be assumed to be a maximum.

Microfilm $2.00; Xerox $4.20. 77 pages.

THE NATURE OF THE BLACK SHANK-ROOT-KNOT DISEASE COMPLEX IN FLUE-CURED TOBACCO AND ITS CONTROL BY BREEDING FOR RESISTANCE TO BOTH PATHOGENS

(L. C. Card No. Mic 59-348)

Nathaniel Thomas Powell, Ph.D.
North Carolina State College, 1958

Supervisor: Charles Joseph Nusbaum

Resistance to Meloidogyne incognita and M. incognita acrita was incorporated into black shank resistant varieties Dixie Bright 101 and Coker 139 by a backcross procedure. United States Department of Agriculture breeding lines Bel 4-30 and Bel 5-56 were used as sources of nematode resistance.

Inoculation of backcross progenies with eggs and larvae of M. incognita acrita demonstrated that root-knot resistance in these crosses was controlled by a single dominant gene, or was included in a block of genes behaving as a single dominant factor.

Backcross progenies were separated into root-knot resistant and susceptible segregates by inoculating with M. incognita acrita, noting the presence or absence of infection

on the roots, and taking vegetative cuttings to perpetuate each plant. The recurrent parents and root-knot susceptible and resistant segregates of backcross progenies were inoculated with black shank fungus (Phytophthora parasitica var. nicotianae) alone and in combination with M. incognita acrita. Black shank was much more severe among plants of the recurrent parents in the presence of both pathogens than among plants inoculated with the fungus alone. Similarly, the incidence of black shank was significantly higher among root-knot susceptible segregates inoculated with both pathogens than among root-knot resistant segregates under the same conditions. There were no appreciable differences in black shank development when root-knot susceptible and resistant segregates were inoculated with the fungus alone.

Root infections involving both the black shank fungus and root-knot nematodes were studied histologically. Nematode larvae were capable of penetrating roots of root-knot resistant plants. Nematode entry into susceptible plants appeared to enhance fungus ingress very slightly.

The black shank fungus apparently had an affinity for hypertrophied and hyperplastic areas of galled tobacco roots. In such regions, the mycelium was more intensive and vigorous than in non-galled areas. Hyphae progressed rapidly and directly into hyperplastic tissue and giant cells. After fungus invasion, a compatible relationship apparently existed between pathogen and host in cells undergoing hyperplasia. Giant cells, although conducive to fungus invasion, seemed highly sensitive to infection. They degenerated rapidly and, within 72 hours after fungus invasion, appeared completely devoid of protoplasm.

Microfilm $2.00; Xerox $4.80. 94 pages.

STUDIES ON RESISTANCE IN TOMATO TO ROOT-KNOT NEMATODES

(L. C. Card No. Mic 59-349)

Robert Dale Riggs, Ph.D.
North Carolina State College, 1958

Supervisor: Nash Nicks Winstead

Resistance to 4 species of the nematodes causing root knot has been found in a wild species of Lycopersicon. These studies were undertaken in an attempt to discover some of the factors relating to resistance and if possible to determine the nature of the resistance.

The factors for resistance or susceptibility to root-knot nematodes in tomato was found to be located in both the tops and roots of plants. They were not translocated across a graft union.

Studies involving differences in proteases, alkaloids, and phenols of the resistant and susceptible tomato lines were inconsistent and inconclusive.

Larvae of root-knot nematodes were found to penetrate the roots of resistant plants as freely and as rapidly as they penetrated roots of susceptible plants. However, the invasion of the resistant tissues resulted in the death of tissues around the invading larvae and the subsequent death of the larvae. The effects on the cells surrounding the larvae were noted as soon as 24 hours after root tips were inoculated and within 48 hours the cells appeared to be dead. It is suggested that the hypersensitive reaction is associated with the excretion of a toxic material by the nematodes which kills the host protoplasm. Nematode larvae were dead within 96 hours after inoculation.

Larvae which did develop in resistant plants formed galls on both resistant and susceptible plants which were indistinguishable from the galls formed by the parent populations on susceptible plants.

When larvae from nematodes reproducing on resistant tomato plants were transferred continuously to other resistant plants, virulent populations of each of the 3 species of the root-knot nematodes were developed. These parasitized resistant Hawaii 5229 tomato plants as severely as the parent populations parasitized susceptible STEP 174 tomato plants.

No variations in virulence were found in single larva cultures from the B population of M. incognita to resistant or susceptible tomato plants.

In general, resistant varieties of other crop plants tested with M. incognita acrita B were found to be resistant to this population also.

There were some indications of morphological differences between the perineal patterns of the B populations and the parent populations. However, these were not distinct enough to distinguish between the two. The larvae of each of the B populations were shorter than larvae of the respective A populations. The B populations which attacked the tomato line carrying the Mi gene were concluded to be new physiological strains of M. incognita, M. incognita acrita, and M. arenaria.

Microfilm $2.00; Xerox $4.00. 73 pages.

FACTORS AFFECTING VARIETAL DIFFERENCES IN PROTEIN CONTENT OF WHEAT

(L. C. Card No. Mic 59-351)

Jagdish Seth, Ph.D.
North Carolina State College, 1958

Supervisor: Teddy T. Hebert

Two high and two low protein wheat varieties were grown in the field and in the greenhouse for studying the factors affecting varietal differences in protein content of wheat. Total nitrogen of kernels for the greenhouse plants was subdivided into protein and non-protein fractions.

Tops, roots, immature heads, and kernels of wheat plants grown in the field were analysed for total nitrogen at six different stages of growth of the plant. Wheat varieties grown in the field showed no differences in their capacity to absorb nitrogen at least during the earlier stages of plant growth. During kernel formation there was higher protein content of the kernels and a lower protein content of the roots of high protein varieties than of low protein varieties. There was also a greater rate of increase in protein content of the kernels of high protein varieties during kernel formation. This indicates that translocation of nitrogenous compounds from vegetative parts to the heads and the rate of increase in protein content influenced in part, the varietal differences in protein content of wheat plants.

No differences were observed in root growth between

high and low protein wheat varieties when grown in a transparent plastic case. This observation together with the results obtained from plants grown in solution culture showed that extension of the root systems of the plants does not play a major role in producing varietal differences in protein content.

Tops, roots and kernels of wheat plants grown in the greenhouse in solution culture were analysed for total nitrogen. No differences were found in the protein content of the vegetative parts of the plants, although there were significant differences in the protein content of the kernels. The high protein varieties had a higher protein content than the low protein varieties. These results indicate that rhizosphere did not influence the varietal differences in protein content of wheat.

Wheat plants grown in sterilized soil in greenhouse were treated with ammonium, nitrate and urea forms of nitrogen using different methods of application. The different forms of nitrogen were applied into the soil as well as on leaves of the plants. The foliar application of nitrogen was made both before and after heading of plants.

The results showed an increase in protein content of the kernels of wheat plants when nitrogen was applied either into the soil or sprayed on the leaves. The plants, however, showed greater response to nitrogen applied into the soil than to that applied on leaves. Although there was an increase in protein content of the kernels of the plants treated with nitrogen either before or after heading of the plants, the latter application gave greater increase in protein content. In all nitrogen treatments, varietal differences in protein content were maintained. These results indicate that differences in protein content of wheat varieties were not related to the ability to reduce nitrate nitrogen. Percentage of total nitrogen in the non-protein form was higher for low protein varieties than for high protein varieties indicating that the high protein content of high protein varieties was not due to the total nitrogen in non-protein form.

Wheat plants grown under normal daylight in addition to artificial light maintained varietal differences in protein content, although the protein content of all varieties increased.

High protein content of kernels of wheat plants grown in the field was found to be positively correlated with lateness of heading in progenies from one cross, whereas, no correlation was established between protein content and awnedness in progenies of another cross.

Microfilm $2.00; Xerox $4.20. 79 pages.

A STUDY OF THE APHID TRANSMISSION AND FIELD SPREAD OF POTATO VIRUS Y IN WISCONSIN

(L. C. Card No. Mic 59-1183)

Allison Bennett Stevenson, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor R. Keith Chapman

Previous studies on potato virus Y (PVY) in Wisconsin have shown that the virus is generally much more prevalent in the Kenosha area than in the seed-growing area near Rhinelander. Results obtained in the early stages of the investigation, suggested that such differences might be due to other factors in addition to the relative abundance of virus sources. As a result, investigations were undertaken in 1957 and 1958 to compare the spread and transmission of PVY in the field at several locations in Wisconsin.

In 1957, less than one percent infection in small plots of Cobbler potatoes located in four areas of the state was introduced from outside sources. In plots with a source of the virus provided, the spread was considerably more extensive at Kenosha than at Rhinelander, Stevens Point, or Madison. Controlled transmission of the virus to individual potato plants in the field by green peach aphids, Myzus persicae (Sulz.), did not occur more readily at Kenosha than at Rhinelander or Madison. Transmission of the virus to Havana 38 tobacco in the field and greenhouse indicated that, on some occasions, transmission occurred less readily in the field. Potato plants grown in the field at Rhinelander, Madison, and Kenosha, and greenhouse-grown plants, were equally susceptible to aphid inoculation with PVY in the greenhouse.

In the greenhouse, green peach aphids acquired PVY most readily when given the opportunity to make several punctures on infected tobacco, but transmission was decreased by a 15-minute acquisition time. With infected tobacco and potato leaves, no difference could be demonstrated in acquisition from the upper or lower surfaces. Aphids acquired the virus as readily from the stems of infected potato plants as from leaves.

Transmission to tobacco increased slightly with increasing inoculation times, but most of the infective punctures occurred within five minutes after aphids were placed on test plants.

No consistent differences could be demonstrated between winged and wingless green peach aphids in efficiency of transmission, either as adults or immature forms. One-day-old aphids transmitted PVY as readily as four-day-old aphids, and only slightly less efficiently than eight-day-old aphids. Green peach aphids reared on tobacco were more efficient than those reared on cabbage in transmission of PVY from tobacco, but not from potato. No difference in efficiency could be demonstrated between aphids reared on tobacco and potato.

Green peach aphids recovered PVY from aphid-inoculated leaves of tobacco plants six days after inoculation, and from the younger non-inoculated leaves in eight days. The virus was recovered by aphids from sap-inoculated plants in four days. In potato, recovery of the virus by aphids from inoculated leaves occurred in ten days to two weeks after inoculation, and from non-inoculated leaves in 15 to 20 days.

Green peach aphids recovered PVY from tobacco at an earlier date after inoculation by 25 or 10 aphids, than by one or two aphids, and the plants inoculated with the larger numbers were subsequently more infective to aphids. The virus moved out of tobacco leaves inoculated with 25 aphids in less than 24 hours, and from sap-inoculated leaves in less than 48 hours, but not from all leaves inoculated with 10 or two aphids until three days after inoculation.

There was some evidence that dilution of sap inoculum increased the time required for recovery of PVY by aphids from inoculated tobacco plants, and affected the subsequent infectivity to aphids.

Exposure of PVY-infected potato plants to sunlight for

several days did not reduce the infectivity of the plants to aphids. On some occasions, exposure of healthy tobacco plants to sunlight for several hours before aphid inoculation with PVY apparently decreased transmission. Exposure of tobacco plants to sunlight for several hours immediately after inoculation by aphids, making single punctures on the upper surfaces of the leaves, reduced transmission. Microfilm $2.00; Xerox $6.00. 123 pages.

PLANT AND SOIL FACTORS INFLUENCING THE MINERAL NUTRITION OF PLANTS

(L. C. Card No. Mic 59-354)

Grant Worthington Thomas, Ph.D.
North Carolina State College, 1958

Supervisor: Nathaniel Terry Coleman

Greenhouse experiments were carried out growing ladino clover, sweet corn and snap beans in five North Carolina soils with different chemical properties. In addition, sweet potatoes were grown in the field and in sand culture. Widely varying factorial combinations of KCl and Ca - Mg (lime) were applied and plant growth and ion content studied.

It was found that the addition of lime greatly increased growth and divalent cation content of plants at all KCl rates. The addition of KCl always resulted in an increase in K and Cl content but usually failed to increase or depressed growth unless lime was present. The growth and ion contents of plants receiving identical nutrient treatments, but grown on different soils, were influenced greatly by the type of exchanger present in the soils. The order of K and Mg availability was: organic colloid > montmorillonitic > kaolinitic, while for Ca the order was: montmorillonitic > kaolinitic > organic. Plants also showed great differences in inorganic composition, with ladino clover, snap beans and sweet potatoes being highest in Ca, and sweet corn high in Mg relative to Ca. All plants were quite similar in K contents.

The use of "ratio law" equilibrium measurements to predict ion contents of plants was investigated. It was found that a good linear correlation between K content of plants and the function $pK - \frac{1}{2}p\,Ca$. The fundamental nature of this function and the ease of determination were thought to warrant its use.

Losses of nutrients were studied in the field and in one greenhouse experiment. Soil samples showed that leaching removed salts from the root zone rather slowly during the growing season, because of drying conditions which brought the salts toward the surface between rains, and because of salt absorption by the plant roots.

Activity of the enzyme, phosphoenalpyruvate carboxylase, as influenced by ion contents of sweet potato leaves, was studied. It was found that leaves which were high in K and Mg possessed high enzyme activity, while low K and Mg and high Ca in leaves was associated with low activity. The addition of Mg to the enzyme assay restored activity in Mg deficient leaves, but the addition of K had a slightly inhibitory effect.

Microfilm $2.60; Xerox $9.00. 198 pages.

THE CHEMISTRY OF SOIL COPPER

(L. C. Card No. Mic 58-5517)

Lun-Shin Wei, Ph.D.
University of Illinois, 1958

Studies were made to follow the chemical reactions of copper added to soils and to characterize the forms of copper present in soils. Three types of soil, Elliott silt loam, Sable silty clay loam, and Oquawka sand, differing in base-exchange capacity and organic matter content, were used. The studies included the effects of time of contact, pH and concentration on copper sorption, and fixation under various treatments as well as the extraction of native soil copper with Versenate, and the intensities of copper adsorption by soils. To further characterize the reactions taking place between added copper and soils, the effect of H_2O_2 treatment on copper adsorption was studied.

The results obtained led to the following conclusions:

(1) Soil organic matter held copper more tightly than did clay minerals. Organic matter adsorbed copper tightly against both hydrolysis and acidification. However, the copper adsorbed by clay minerals was more easily subjected to hydrolysis and acidification losses.

(2) Copper added to soil was first adsorbed by the soil organic matter until its base-exchange capacity was saturated quantitatively, then it was adsorbed by the clay minerals. Time of contact had no effect upon copper adsorption by soil.

(3) Copper adsorbed by soil organic matter followed Freundlich's adsorption equation. On the other hand, copper adsorbed by clay minerals followed Langmuir's adsorption equation.

(4) The precipitation of added copper as $Cu(OH)_2$ may have taken place in Oquawka sand, but probably not in Elliott silt loam, as the pH increased from 4 to 8.

(5) Copper added to calcium-saturated Elliott silt loam was irreversibly exchanged with calcium. The reactions taking place, in addition to the copper complexed by the organic matter and fixed in interlattice form, were postulated to be as follows:

(a) $Ca = clay + CuCl_2 + H_2O \rightleftharpoons clay + CaCl_2 + H_2O$

(b) $Cu = clay + H_2O \rightleftharpoons (HO - Cu) - clay - H$

The relative ease of release of copper (fcu = 0.56) calculated for the above system may not be correct. In H-systems where an excess of H ions should result from copper adsorption, $(HO - Cu)^+$ formation would not be possible, and the fcu value may hold.

(6) Extraction of copper from soil with Versenate at low pH (nearly 4) was essentially an exchange reaction between the Cu-Versenate complex and Cu-soil complexes. The following expression might hold:

$$K\ apparent = \frac{MY}{C_m C_y} = K_{my}\ \alpha_4\ \beta$$

The β in this case would represent the stability of the copper-soil complexes. For the complete extraction of soil-complexed copper, Versenate solution with a higher pH should be used.

(7) The copper in soils of normal pH range was probably present mostly in an organic-matter-complexed form and a (HO-Cu)-clay-H form, and only a trace of copper may have existed in an exchangeable form (Cu = clay).

Microfilm $2.00; Xerox $4.20. 77 pages.

ANATOMY

A STUDY OF THE CELLULAR REACTIONS WITHIN REGENERATING SKELETAL MUSCLE AFTER DENERVATION

(L. C. Card No. Mic 58-5134)

Gregory Morris Dillard, Jr., Ph.D.
Emory University, 1954

The regeneration of the rat's gastrocnemius muscle which followed a denervation of 20 days was the product of the concerted activity of each of the tissues within that muscle. The orderly sequence in which the stages of increase and of decrease in activity of one tissue was followed or overlapped by the increment and decrement in that of another suggested a succession of stimulating and inhibiting factors. Although these separate factors eluded final analysis, the temporal relationships of these changes implied a series of interlocking causal effects.

Although the debris of degenerating axis cylinders and myelin had been removed prior to the beginning of this study, their breakdown products may have remained. If so, these products which in other tissues were able to stimulate the formation of accessory neural tubes may have initiated the multiplication of the Henle cells and the outer cells of the sole plate. This multiplication was excessive for many of these immature cells disintegrated. Each of these two cells contained large amounts of nucleoproteins. Nucleic acids and their hydrolytic products have long been known to stimulate leucocytosis. Great numbers of neutrophiles invaded the connective tissue of the denervated muscles during the time when this process of cellular fragmentation was at its height.

Although no cellular debris was identified within the clasmatocytes, they were present throughout the endomysial and perimysial planes of the supporting tissue in increased numbers for the first 12 weeks of regeneration. Their greatest numbers coincided with the time not only when the immature Henle cells and outer cells of the sole plate were degenerating but also when the perivascular cells were undergoing their greatest degree of fragmentation. When the number of clasmatocytes was again normal, all fragmentation of cells within the operated muscles had ceased.

The secretory activity of the fibroblast (the perimysial fibroblast of this study) was related by Miller ('53) to the depolymerization of the connective tissue within the regenerating gastrocnemius muscle. In the depolymerized state the connective tissue and especially the ground substance was found to be more plastic and gave greater freedom of movement to substances through it and to cells within it (Gersh, '50). The greatest degree of depolymerization of the connective tissues within the operated muscles occurred during the time when the muscle fibers achieved the greatest increment in their diameters. The endomysial fibroblast, on the other hand, maintained the depolymerized state of the endomysial connective tissue for a longer period of time than did the perimysial fibroblast. This longer period of plasticity within the endomysial connective tissue coincided with the period of slow increase in the lateral expansion of the muscle fibers within the operated muscles and terminated at the time when these muscle fibers had reattained their normal dimensions.

Several new chapters in the life history of the connective tissue mast cell were discovered in this study. These cells differentiated from perivascular cells which multiplied in the connective tissue surrounding the blood vessels. This interpretation of kinship between the perivascular cell and mast cell was strengthened by the finding that the cytoplasmic granulations and the nucleolus of the former and the transitional forms of the latter resisted ribonuclease digestion. The histamine which is freed by the fragmentation of mast cells could have facilitated the transfer of chemical substances through the depolymerized connective tissue because of the local vasodilatation which it stimulated. For, mast cells studded the larger blood vessels and even the terminal capillaries during the time when the greatest degree of depolymerization of the connective tissue was present.

The Schwann cells did not perform their traditional task of pioneering the route for the regenerating nerve fiber to follow. These routes were outlined and maintained by the cells of the sheath of Henle. Schwann cells did, however, provide the new inner cells which reappeared in the old sole plates.

The outer cells of the sole plates within the operated muscles did not degenerate as did the inner cells. Rather, they multiplied in a manner similar to that which distinguished the Henle cells. Each of these cells enlarged. Many small cells were seen within the cytoplasmic membrane. The membrane ruptured. The small differentiated cells were freed. The Henle cells and the outer cells of the sole plate were characterized not only by this peculiar mode of multiplication which produced many small dedifferentiated cells but also by similar modes of nucleoprotein reformation accompanied by similar increments and decrements in cellular mass. This process of nucleoprotein reformation shared even in the minutest detail by these two cells was similar to that which distinguished the restitution of nucleoproteins within the nerve cell after injury to its axone. Since this process of nucleoprotein reformation characterized only the specialized cells of the mammalian body during their cyclic stages of activity, the cells of the sheath of Henle and the outer cells of the sole plate must contribute something vital to the normal activity of skeletal muscle.

Furthermore each of these two cells contained similar ribonucleoprotein granulations similarly placed within their respective cytoplasms. These criteria proved these cells to be similar and suggested that they shared a common ancestral cell. Certainly, the cells of the sheath of Henle presented not a single cytological characteristic of the fibroblast, and the outer cells of the sole plate were not muscle nuclei.

The process of reparation of the muscle fibers within the operated muscles was a gradual one and preceded not by muscle bundles but rather muscle fiber by muscle fiber. For, as the number of muscle fibers containing the enlarged nuclei of atrophic muscle fibers decreased, those containing the smaller nuclei of normal muscle fibers increased. Not until the last five weeks of regeneration (12 to 17) did the muscle fibers containing normal nuclei dominate the picture. At the beginning of this five week period the outer cells of the motor end plate were mature. At the end of that period of time all but a few of these sole plates contained inner cells. Also the last increase in diameter of the muscle fibers had been added, and the contractile strength of the operated muscle commanded by the nerve was equal to the contractile strength of the muscle itself (Hines and Knowlton, '54). The activity of the cells of the supporting tissues had subsided. The processes of restitution within the denervated muscle had ceased.

In conclusion the denervated gastrocnemius muscle of the rat reacted as an organ during its regeneration. Each type of tissue took part in this process. Although the separate stimulating and inhibiting factors which controlled the activities of each of these tissues remained unknown, this study uncovered several hitherto unknown findings which further our understanding of the processes which characterize the restitution of denervated skeletal muscle.

Microfilm $2.00; Xerox $5.40. 106 pages.

EFFECTS OF SYMPATHETIC AND PARASYMPATHETIC STIMULATION ON SALIVARY SECRETION

(L. C. Card No. Mic 59-915)

Richard G. Quevy, Ph.D.
St. Louis University, 1958

Various investigators have described a dual autonomic innervation of the serous and mucous components of the submandibular gland (Hitzker, 1914; Chauchard, 1937; Hillarp, 1949). Other workers have indicated that the various glandular components are singly innervated by either the sympathetic or parasympathetic nerves (Stormont, 1926; Rawlinson, 1923; Langeskiôld, 1941; Lundberg, 1955).

It is generally believed that trophic and vasodilator impulses to the submandibular gland are parasympathetic in nature while vasoconstrictor impulses are carried by the sympathetic components. Secretory activity may be either sympathetic or parasympathetic (Babkin, 1929-1930). Salivary secretion resulting from sympathetic stimulation is said to be due to vasomotor activity while secretory parasympathetic nerves directly affect the alveolar cells (Kuntz and Richins, 1946; Richins and Kuntz, 1953).

This investigation attempts to clarify the conflicting data by use of experimental methods which allow histological observation of the individual cellular components and their reactions. Sympathetic effects on the submandibular and parotid glands of cats were produced by electrical stimulation of the distal ends of the severed cervical sympathetic trunks. Stimulation of the distal end of the severed chorda tympani produced parasympathetic effects in the submandibular gland, while such activity in the parotid was effected reflexly by stimulation of the central stump of the vagus nerve cut peripheral to the nodose ganglion. In some experiments autonomic drugs were used to selectively depress the adrenergic and cholinergic nerve components. Some experiments were performed with the blood supply to the glands occluded in efforts to determine the significance of vasomotor activity. Control and experimental tissues were fixed in Zenker's-formol solution and stained on the same slides with Orange G - Crystal Violet.

Sympathetic stimulation decreased the staining reactions in the mucous alveoli and granular cytoplasm of the serous alveolar cells and ducts of the submandibular gland. Similar changes were also observed in the parotid gland, but only when the cholinergic components were depressed. The sympathetic effects on the submandibular gland were observed only when the vagal pathways were functional. The data indicate a synergistic relationship between the sympathetic and parasympathetic nerves. Secretion in the alveolar cells and ducts of the glands is probably stimulated by an adrenergic humoral mediator released from the vascular beds, since occlusion of the blood supply nullified all the above secretory effects. This confirms the work of Richins and Kuntz (1953).

Vagal reflex stimulation produces a depletion in the granular cytoplasm of the serous cells of the parotid gland, and stimulation of the chorda tympani produces an intense granular depletion in the cytoplasm of the serous and duct cells and a decreased staining reaction in the mucous cells of the submandibular gland.

Microfilm $2.00; Xerox $3.60. 63 pages.

EFFECTS OF CHOLINE DEFICIENCY ON THE MITOCHONDRIAL MORPHOLOGY IN THE RAT

(L. C. Card No. Mic 59-919)

Brother Simeon Ryan, O.S.F., Ph.D.
St. Louis University, 1958

In 1932, Best and Huntsman reported that choline deficiency caused fatty livers in rats. In 1939 Griffith and Wade showed that the same choline deficiency also caused cortical necrosis and hemorrhage in the kidney of the rat.

The purpose of the present study was to learn if a choline deficient diet showed any cytological effects on the mitochondrial picture as revealed by a modified Regaud cytological technique. This modification was accomplished by fixing tissues for 24 hours in formol-saline. They were then subjected to a 3% potassium dichromate at 37° C. for 48 hours.

Male rats, 20 - 25 days old of the St. Louis University strain, weighing 40 - 45 grams were placed on highly purified choline deficient and control diets. The deficient diet was fed for a period of eight and ten days to 10 rats. This same diet, to which choline had been added, was fed to another group of 10 rats. Another group of 10 animals were

fed a purina diet. A 12 day choline recovery group, in addition to its control group were also run.

The Regaud procedure revealed the following pictures. In the convoluted tubules of the renal cortex of the controls, mitochondria appeared as densely packed granules arranged in linear pattern. While in the choline deficiency kidney, the proximal and distal convoluted epithelium showed that the mitochondria appeared as granules, sparsely populated. In the severely damaged areas the mitochondria frequently disappeared. Deficient animals placed on a control diet showed a return to the control picture.

The liver mitochondria of the control animals were mostly granular or short rod-like in form and densely populated. In the choline deficient livers the mitochondria appeared smaller and much fewer in number. In these sections the granules tended to be concentrated around the periphery of the fat vacuoles. Deficient animals placed on the control diet brought about an increase in population of mitochondria.

This renal mitochondrial picture does not appear to be specific for choline deficiency since a similar renal picture has been described by Bloom in 1943 who noted the effects of Bright's disease on mitochondrial morphology in the renal cortex of dogs. And again, Oliver in 1953 described a similar mitochondrial pattern after subjecting his rats to sub-lethal dosages of corrosive sublimate.

In liver and kidney, the mitochondrial population is decreased in the deficient choline state. Two possible explanations for the effects of choline deficiency are offered. (1) A direct effect induced by the choline deficiency on the tissues involved. (2) An indirect effect produced by the lack of choline which thus interferes with the fat metabolism of the cells.

In either case the disrupted mitochondrial picture appears to reflect the general physiological condition in the liver and kidney and may serve as a morphological index to the physiological state of the cells.

Nutritional choline deficiency is capable of inducing changes in the form and population of renal and hepatic mitochondria as revealed by a modified Regaud technique.

Microfilm $2.00; Xerox $3.60. 61 pages.

ANTHROPOLOGY

MISTASSINI HUNTING GROUPS AND HUNTING TERRITORIES

(L. C. Card No. Mic 59-332)

Edward S. Rogers, Ph.D.
The University of New Mexico, 1958

This dissertation analyzes the factors which have influenced the development of hunting territories and the size of hunting groups among the Mistassini Indians of south-central Quebec.

In order to isolate the factors responsible for hunting group size and development of hunting territories, an investigation is made of the natural environment, the effects of European contact, and all aspects of Mistassini culture except mythology and language. Data for other eastern subarctic groups are utilized to amplify Mistassini materials and as a control. Data for the present-day Mistassini are the result of field work conducted during 1953-54.

The materials are presented in three parts. The first part consists of a historical sketch describing the contact between Europeans and the Mistassini and a cultural sketch of Mistassini social organization, material culture, and religion. The second part is a detailed account of environmental conditions, subsistence and the yearly cycle, the hunting group and the hunting territory. Part three is devoted to an analysis of the data.

Some authorities have stated that small hunting groups and hunting territories in the eastern subarctic were aboriginal, reflecting environmental conditions; others maintain that these features resulted from the introduction of a fur trade economy. Analysis of the Mistassini material does not fully substantiate either point of view. In the first place, the data indicate that the hunting group and hunting territory are independent, rather than interdependent variables. Second, instead of a single factor influencing the formation of the hunting group, several factors are involved.

Hunting group size, which has remained constant since the 1600's, is found to be the result of a balance between opposing factors, some of which tend to inhibit group size, while others encourage increased size. Three types of factors are involved: the relation between the environment and Mistassini technology; non-material features of the culture acting independently of the environment; and the introduction of a fur trade economy.

Historical evidence indicates that hunting territories were not present at the time of contact. They developed during the nineteenth century as a result of changes in property concepts brought about by the fur trade.

Microfilm $3.60; Xerox $12.20. 280 pages.

STUDIES ON THE PHYSIOLOGY AND PATHOGENESIS OF LEPTOSPIRA POMONA

(L. C. Card No. Mic 59-1384)

Frank McCalla Boyd, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor J. B. Wilson

The growth of Leptospira pomona in Chang's fluid medium under various conditions was measured by optical density measurements and direct microscopic counts. These two methods did not give good correlation with individual cultures but demonstrated reasonable agreement with groups of cultures.

The optimum pH of Chang's medium with rabbit serum was found to be 7.2 to 7.4. Best growth occurred at a concentration of 7 to 10 per cent rabbit serum or at 7 to 9 per cent sheep serum. Although bovine serum could support some growth, it inhibited growth in the presence of rabbit serum. Cultures would only survive a few transfers in Chang's medium with bovine serum.

The optimum oxygen tension for growth in Chang's medium was from 10 to 20 per cent of the atmosphere of the culture flask. The optimum range of carbon dioxide concentration was from 0.05 to 4 per cent.

No growth of L. pomona was obtained in the modified synthetic medium of Savino and Rennella (1942) or in the garden soil-coli medium of Hein (1950). Tween 80 added to Chang's medium in concentrations of 0.2 to 2 mg/ml inhibited growth.

Two cultures of L. pomona were found to have lost virulence for hamsters after two transfers in Chang's medium while one culture gained in virulence after two transfers.

Inoculation of hamsters with up to 2.4×10^7 heat-killed or 4×10^6 formalin-killed leptospirae and guinea pigs with up to 4×10^7 heat-killed organisms did not produce a titer by the agglutination-lysis test. This indicates that a positive agglutination-lysis test would be an indication of infection.

L. pomona was most frequently recovered from the spleens of experimentally infected hamsters. The spleen cultures were positive from 96 per cent of the animals from which leptospirae were recovered. This compared with 70 per cent of blood cultures, 51 per cent of kidney cultures, and 41 per cent of liver cultures. The organisms were consistently recovered from the spleen from the first day after inoculation while the other organs showed peak infection at certain periods over the course of the disease.

A strain of L. pomona lethal for hamsters produced hemolysis more rapidly and to a higher titer than did its parent strain which was not lethal for hamsters. Only the lethal strain hemolyzed hamster red blood cells to a dilution of 1:3.

Dihydrostreptomycin and Terramycin in 3 daily doses of 1.67 mg and 0.5 mg per hamster, respectively, protected the animals against lethal leptospirosis when administered as late as 4 days after inoculation with L. pomona. Five hundred units of penicillin per day was less effective and 0.5 mg of Achromycin per day gave little protection.

Microfilm $2.00; Xerox $5.20. 105 pages.

A STUDY OF SPOROGENESIS IN CLOSTRIDIUM ROSEUM

(L. C. Card No. Mic 59-487)

Robert Eugene Collier, Ph.D.
University of Illinois, 1958

Although some studies have been performed concerning the sporulation process in aerobic spore forming bacteria, few studies have been made with the anaerobic spore formers. It was found that the endotrophic method of studying sporulation in aerobic bacteria (Hardwick and Foster, J. Gen. Physiol., 35, 907-927, 1952) was not applicable to anaerobic spore formers. Thus, a new method of studying the sporulation process was developed for the anaerobic spore former, Clostridium roseum. This method is called the active culture method and is based on the theory that by placing greater emphasis on the inoculum used in the sporulating culture, a homogeneous population of cells can be obtained with the result that all cells produce spores at approximately the same time. This homogeneous inoculum was obtained by transferring the culture thrice before it was finally placed into the sporulating medium. The amount of each transfer consisted of a volume equal to 10 per cent of the next culture medium. These transfers were made when the cells reached near maximum growth but contained a minimum number of heat resistant cells. The sporulation medium was highly buffered with a combination of tris (hydroxymethyl)aminomethane and dipotassium hydrogen phosphate to neutralize the acid produced by the active culture.

It was found that washed, aerated cells of Clostridium roseum containing spores as determined by staining lysed, yielding free, ungerminated spores.

After inoculation of the sporulation medium with an active culture of Clostridium roseum, total viable count reached a maximum within $3\frac{1}{2}$ hours at 37 C. After a time lag of about one hour, 100 per cent spores as determined by staining occurred. Synthesis of maximum dipicolinic acid occurred $1\frac{1}{2}$ hours after the formation of 100 per cent spores as determined by the above procedure. Maximum heat resistance was reached four hours after synthesis of maximum dipicolinic acid.

No dipicolinic acid was released from heat sensitive cells exhibiting maximum content of the acid when they were heated at 80 C for 15 minutes.

Chloramphenicol was added to an active culture of Clostridium roseum after it reached maximum growth but before dipicolinic acid or heat resistant cells were present.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A concentration equal to five times that amount needed to inhibit vegetative growth of the organism had no effect on the formation of dipicolinic acid and negligible effect on the formation of heat resistant forms.

Penicillin or air had a similar effect on the sporulation process of Clostridium roseum. When these agents were added to a culture after maximum growth occurred with the absence of dipicolinic acid, neither synthesis of the acid nor formation of heat resistant spores was observed. A 95 per cent killing of the cells was observed after the addition of these agents at this time interval. When penicillin or air was added to the culture after the formation of maximum dipicolinic acid, no pronounced inhibition of the formation of heat resistant spores occurred.

Of several pyridine carboxylic acids studied, only pyridine-2-carboxylic acid inhibited the sporulation process of Clostridium roseum. The action of this acid could not be reversed by either dipicolinic acid or nicotinic acid.

Dipicolinic acid, when added to a sporulating culture of Clostridium roseum at different time intervals, had no effect on the sporulation process.

Microfilm $2.00; Xerox $5.00. 97 pages.

B-D-GALACTOSIDASE OF ABERRANT COLIFORM BACTERIA

(L. C. Card No. Mic 58-7121)

Antone K. Fontes, Ph.D.
Michigan State University, 1957

The presence of B-D-galactosidase in several aberrant coliform organisms was demonstrated. These organisms, recovered from lakes and rivers in selective and differential media used in routine water analysis, failed to utilize lactose in the typical manner.

Cell-free extracts prepared from one of these atypical organisms was compared to like extracts from a typical coliform organism. Simple kinetic studies of the enzymes, in both extracts, indicated that they are very much alike in respect to affinity for the synthetic substrate ONPG.

Studies, on intact cell suspensions and cell-free extracts of these aberrant organisms, showed that the activity of the enzyme was much lower than from like preparations of typical coliform organisms.

Microfilm $2.00; Xerox $3.80. 70 pages.

CHARACTERISTICS OF AN ORNITHOSIS VIRUS STRAIN OF LOW VIRULENCE

(L. C. Card No. Mic 59-1265)

Charles Gale, Ph.D.
University of Minnesota, 1958

The reports of a number of human cases of ornithosis as a result of exposure to turkeys has stimulated wider interest in this disease. The highly virulent strains of ornithosis have been studied extensively, while strains of low virulence have not been widely explored. The purpose of this thesis was to study a strain of low virulence.

The virus was characterized in mice by the intraperitoneal, intracerebral, and intranasal routes. It caused a relatively mild infection in mice when injected intraperitoneally with very low mortality. The gross lesions in mice consisted of ascites, enlarged spleen and liver with a cellular deposit on the visceral organs. Histological examination of the liver and spleen showed cellular infiltration. Macchiavello's stained smears revealed the presence of elementary bodies. On intracerebral and intranasal inoculation, the mortality was increased markedly. Pneumonia developed as a result of intranasal inoculations. The toxicity determinations of the virus indicate it was extremely low.

In chicken embryos the death pattern and reaction was characteristic of this group of viruses. The virus was found to be susceptible to erythromycin, oxytetracycline, chlortetracycline and penicillin; while streptomycin, dihydrostreptomycin, magnamycin and neomycin were not found effective in preventing the mortality of the chicken embryo.

Turkeys were exposed to the virus by intranasal, intraperitoneal, intratracheal inoculation and contact. Turkeys over 14 days of age exhibited no signs of disease while turkeys under 14 days of age were found to be markedly affected and exhibited a high mortality.

Although few clinical signs of illness were noticeable in older birds, necropsy revealed marked gross pathology. The gross lesions were a pericarditis, perihepatitis and aerosacculitis. Microscopic pathology of the liver, spleen and heart revealed marked cellular infiltration. Macchiavello's stained smears revealed elementary bodies. Intratracheal inoculation resulted in similar lesions to intraperitoneal inoculations with the addition of pneumonia. The serological response detected with the direct and indirect complement fixation test reached its peak at thirty days and then declined. The course of the disease was chronic. The virus was isolated at 72 hours after inoculation and as late as 120 days after exposure.

Chickens and pigeons inoculated with the virus developed a mild subclinical infection similar to that in turkeys, however, the lesions were less severe. Intratracheal inoculations into sheep resulted in pneumonia. The exposure of two pregnant ewes resulted in death of one of the twin lambs in each case. A mild subclinical infection with no lesions developed in guinea pigs, hamsters and rabbits.

Paper-strip electrophoresis examination of turkey, sheep and calf serums showed marked differences in the serum globulin fractions of turkeys and sheep following exposure. The calf was found to show slight serum fraction differences. The turkey and sheep serums showed marked increases in the gamma globulin areas. The serums of calves failed to show detectable antibodies except at low levels using the direct complement fixation test, while the turkey and sheep serums exhibited high titers. A comparison of the capillary tube agglutination test to the direct complement fixation test showed an agreement of 67 per cent within one tube dilution and 78 per cent agreement on positive identification of samples.

Microfilm $2.00; Xerox $6.80. 142 pages.

INTRACELLULAR ANTIGENIC PRECURSORS ASSOCIATED WITH SYNTHESIS OF THE INFLUENZA VIRUS

(L. C. Card No. Mic 59-1467)

Jack Roberti Henderson, Ph.D.
University of Illinois,
Chicago Professional Colleges, 1958

Supervisor: J. Emerson Kempf

Normal and abnormal electrophoretic components derived from extracts of infected chorio-allantoic membranes were detected primarily during the first six hours of membrane infection but not later. The electrophoretic appearance of these antigens proved to be irregular and dependent upon 1) the concentration of infective and non-infective virus contained in the inoculum, 2) the time of membrane harvest following infection, 3) the protein concentration of the membrane extracts and 4) the conditions under which the infected membranes were subjected once harvested. When all of these factors and the incubation temperature were kept constant, the electrophoretic distribution of soluble chorio-allantoic membrane antigens could be reproduced without difficulty.

Distinct and different components appearing in electrophoretic patterns of extracts from infected membranes were isolated by cold methanol and isoelectric precipitation methods. Specific fractions recovered were named N-1, N-2, A-1, A-2, A-3. These components were non-sedimentable at 110,800 g (35,000 rpm) in two hours, non-infective, non-toxic to mice and did not agglutinate chicken red blood cells. Extracts prepared from uninfected membranes consistently revealed a two-component electrophoretic pattern (N-1 and N-2), the other fractions appearing only in patterns of extracts from infected chorio-allantoic membranes.

The concurrent appearance of membrane antigens and specific influenza virus components showed that 1) formation of incomplete virus coincided with the predominance of fraction A-3 appearance during the early stages of allantoic cell infection of membranes injected with a massive virus inoculum, 2) initiation of virus synthesis by the allantoic cells of the chorio-allantois corresponded with the initial appearance of component A-2 when the original standard inoculum consisted of 2.23×10^4 infective and 2.85×10^4 non-infective virus particles, and 3) normal fraction N-1 could not be demonstrated electrophoretically three to four hours following membrane infection but was apparently regenerated during subsequent infection periods and appeared electrophoretically.

The serologic relationships as evidenced by complement-fixation reactions, between various fractions of the influenza virus and components N-1, N-2, A-2 and A-3 isolated from uninfected and infected chorio-allantoic membranes, presented an interesting but by no means complete picture of protein precursor implications during cellular synthesis of the influenza virus. The outstanding features favoring such a relationship were evidenced by 1) the appearance of new intracellular membrane antigens within six hours following introduction of infective virus into the allantoic sac of the developing chick embryo, and 2) the immunologic similarities between certain antigens isolated from infected membranes and various purified and degraded forms of the virus. The appearance of these new components may well be part of a specific allantoic cell protein reorientation process developed to accommodate synthesis of virus.

Microfilm $2.00; Xerox $4.20. 77 pages.

DERIVATION OF BACTERIA FROM PLEUROPNEUMONIA-LIKE ORGANISMS (PPLO)

(L. C. Card No. Mic 59-762)

William Henry Kelton, Ph.D.
The Pennsylvania State University, 1958

In experiments with pleuropneumonia-like organisms (PPLO) of avian sources, bacteria were derived from 21 strains by culturing these organisms in shallow broth cultures. In addition, bacteria were derived from seven additional strains of PPLO, of which three were obtained from the uro-genital tract of humans, three were isolated from dogs and one was a saprophytic strain isolated from compost. The same shallow broth technique was used to derive bacteria from the seven additional strains. Two of the bacterial strains were identified as Streptococcus liquefaciens and the other 26 as strains of Micrococcus.

The problem undertaken in the experimental work was to show evidence that conversion from PPLO to bacterium took place in deriving the bacterial forms from the PPLO cultures.

Extensive efforts were made to reconvert the bacterial forms to PPLO using penicillin, glycine and thallium acetate singly and in combinations under aerobic conditions of incubation. Twenty experiments were accomplished, and in none was any PPLO encountered.

However, using 2% sodium chloride in the medium along with penicillin and thallium acetate and anaerobic incubation, at least two of the bacterial strains were reconverted to the PPLO. Since no PPLO were encountered in the aerobic experiments and since the PPLO strains had demonstrated abundant growth under the conditions of these experiments, it was concluded that there were no residual PPLO in the bacterial cultures. These data made the evidence in favor of the conversion from bacterium to PPLO under anaerobic conditions stronger.

In addition, intermediate stages could be demonstrated in both the PPLO when cultured in reduced horse serum concentrations and in bacteria immediately on derivation from the PPLO culture.

When the concentration of horse serum in the PPLO culture was gradually reduced as the culture was transferred, the organisms were induced to take on characteristics which were bacterial in nature. When transferred to solid medium the PPLO colony was larger and more ragged on the edge. Interspersed amongst the ragged PPLO colonies could be found colonies which were about three times larger than the others and which no longer exhibited the dense central portion. One PPLO strain when cultured in medium containing horse serum at 2% level showed only the enlarged colonies with the central portion absent.

The bacterial forms also showed stages of development after making appearance in the PPLO cultures. The bacterial cells at first were predominantly Gram negative and on solid medium presented punctiform, gray, flat colonies with ragged edges. As these bacterial forms were

transferred the cells became Gram positive, and the colonies took on a white color and became more mucoid. Finally, the mature bacterial forms typical of Micrococcus and Streptococcus liquefaciens were obtained.

It is believed that the completion of the cycle from PPLO to bacterium and again to PPLO accomplished with two strains and the demonstration of the intermediate stages in all strains presented sufficient evidence to show that conversion from PPLO to bacterium was accomplished.

Microfilm $2.00; Xerox $4.40. 83 pages.

TYROSINASE AND MELANIN PIGMENTATION IN AZOTOBACTER CHROOCOCCUM

(L. C. Card No. Mic 59-534)

Edward Stanley Kos, Ph.D.
University of Illinois, 1958

The soil bacterium, Azotobacter chroococcum, produces a black pigment which, according to Bergey's Manual, may be due to the conversion of tyrosine to melanin. The present investigation was undertaken to determine some of the characteristics of the tyrosinase system as it exists in Azotobacter chroococcum.

The enzyme tyrosinase catalyzes the oxidation of mono- and dihydroxy phenols and is widely distributed throughout the plant and animal kingdoms. While the enzyme has been very thoroughly investigated in both plants and animals, there has been a lack of quantitative experimentation on this enzyme system in bacteria. The investigation in bacteria has been confined primarily to studies in which the effect on pigmentation of various substrates in culture was observed.

Plant tyrosinases are usually obtained in colloidal solutions and purified by standard enzymological procedures. These enzymes oxidize a great variety of phenolic derivatives. Mammalian tyrosinases are associated with either cytoplasmic particles or melanin granules. These preparations are more specific in their action, attacking either DOPA or tyrosine, rather than related substrates.

Cells were grown for this study on a modified Burk's medium. Resting cell suspensions were used directly or fractionated by sonic oscillation for further study. Pigment granules were isolated by either centrifugation or chromatography on Celite columns. The preparations oxidized DOPA, catechol, tyrosine, and p-cresol. Catechol and p-cresol oxidations were of a higher rate, resembling the oxidation of these substrates by plant tyrosinases. Attempts at purifying the enzyme resulted in the decrease or loss of monohydroxy phenol activity.

Cyanide inhibited the enzyme activity by binding copper ions. This inhibition could be partially reversed through the addition of excess copper sulfate.

A comparison of electron micrographs of the bacterial pigment with natural melanins from mammalian sources indicated a similarity of the bacterial pigment to melanin. The bacterial pigment was reduced in color by hydrosulfite, in a manner similar to mammalian melanin, however, the color could not be restored by ferricyanide.

The data obtained indicate that the bacterial enzyme system resembles mammalian tyrosinase in physical characteristics, however, it is more like plant tyrosinase in its activity and substrate specificity.

Microfilm $2.00; Xerox $4.00. 73 pages.

NITROGEN FIXATION AND HYDROGEN METABOLISM OF AEROBACTER AEROGENES

(L. C. Card No. Mic 59-1404)

Robert Monroe Pengra, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor P. W. Wilson

Although the pathway of biological nitrogen fixation has been studied for a number of years, little is known with certainty regarding the steps from N_2 to NH_4^+. However, many of the characteristics of the enzyme complex that carry out these steps have been established. This research was undertaken in an effort to learn more of this complex.

After a survey of various microorganisms, a strain of Aerobacter aerogenes, strain M5al, was selected for the investigation. Nitrogen fixation was measured by growth in stoppered flasks in the presence of an atmosphere containing N_2^{15} in excess of that in normal nitrogen. The flasks were incubated at 30 C on a rotary shaker. Incorporation of N^{15} into the bacterial protein was taken as evidence of fixation.

Growth curves were run in the shake flasks or in liquid cultures with N_2 bubbled through them for the growth period. The effect of the gaseous inhibitors, H_2 and O_2, on fixation by A. aerogenes was studied in shake flasks. In studies on trace mineral requirements, the media were cleaned of the ions under study with ion exchange resin columns or with chelating agents.

Hydrogenase preparations were made by breaking cells in a sonic field, with the Hughes bacterial press and by grinding in a mortar with levigated alumina. Hydrogenase assays employed a manometric measurement of hydrogen uptake using methylene blue, benzyl viologen or methyl viologen as acceptor and by hydrogen evolution from reduced methyl viologen.

Growth curves of the organism when assimilating ammonium and molecular nitrogen indicated that the nitrogenase system in A. aerogenes is induced by the presence of molecular N_2. The finding that hydrogen competitively inhibits fixation by A. aerogenes adds further strength to the view that hydrogenase is involved in nitrogen fixation. Oxygen inhibition of fixation of nitrogen without inhibition of the utilization of NH_4^+ provides another tool to use in studying the steps from N_2 to NH_4^+.

As has been found for Azotobacter spp., Aerobacter aerogenes requires molybdenum when fixing nitrogen. Its requirement is about one-tenth as high as that of many species of the Azotobacter. Iron also is necessary for the nitrogenase system of A. aerogenes. Calcium, on the other hand, does not appear to be essential.

This organism, as do all other known nitrogen fixers save perhaps Achromobacter, possesses the enzyme hydrogenase. In the cell this enzyme seems to reside on or in a fairly large physical structure. Some preliminary

experiments with N^{15} indicate that here also may reside at least a part of the nitrogen fixing system. The effect of four metal binding agents on this system indicates that iron is involved in hydrogen evolution and oxidation by this organism.

This survey of the physiological characteristics of nitrogen fixation by A. aerogenes suggests that this organism will provide a useful tool for future studies on the mechanism of biological nitrogen fixation.

Microfilm $2.00; Xerox $4.20. 76 pages.

BIOLOGY — GENETICS

MODIFICATION OF EXPRESSION AND MUTABILITY OF STIPPLED ALEURONE (R^{st}) IN MAIZE

(L. C. Card No. Mic 59-1161)

Roland Bruce Ashman, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor R. A. Brink

Previous investigations have disclosed that the aleurone pigment-producing action of the R^r gene (self-colored aleurone) among the offspring of R^rR^{st} (heterozygous stippled) plants is markedly reduced. This effect has focused attention on the nature of the stippled allele and of a variant phenotype termed light stippled (R^{1st}).

It has been shown in the present study that R^{1st} differs from R^{st} only in a modifier located 5.7 crossover units distal to the R locus. The modifier affects the frequency of colored spots in the aleurone layer of the endosperm. $R^{st}r^rr^r$ endosperms averaged 20.3 spots per 5 square millimeters, and $R^{1st}r^rr^r$ endosperms averaged 1.8 spots per 5 square millimeters.

R^{st} and R^{1st} in homozygotes were observed to mutate to self-color (R^{sc}) at the respective rates of 17.0 and $19.9/10^4$ gametes tested. When R^{st} and R^{1st} were heterozygous with r^r (colorless aleurone) they were observed to mutate to R^{sc} at the respective rates of 4.9 and $4.3/10^4$ gametes tested. The basis for the difference in rate of mutation of R^{st} and R^{1st} to R^{sc} in homozygotes and heterozygotes with r^r is not known. Several somatic mutations of R^{st} to R^{sc} were found, which indicates that mutations to R^{sc} are probably not associated with crossing over.

R^{1st} in homozygotes was observed to mutate to colorless or near-colorless aleurone at the rate of $0.4/10^4$ gametes tested. No mutations of R^{st} to colorless or near-colorless aleurone were observed in R^{st} homozygotes. Mutations to colorless and near-colorless aleurone were observed in both R^rR^{st} and R^rR^{1st} heterozygotes. These mutants could have come from either the R^r or R^{st} allele, but in either case the frequency of such mutants was much higher in the R^rR^{st} and R^rR^{1st} heterozygotes than in the R^rR^r, $R^{st}R^{st}$, and $R^{1st}R^{1st}$ homozygotes. The basis for the effect of homozygosity and heterozygosity on the frequency of mutation of R^r or R^{st} and R^{1st} to colorless and near-colorless is not known. Either or both of two mechanisms may be involved: 1) allelic interaction, or 2) unequal pairing and crossing over.

R^{1st} was found to be similar to R^{st} in its effect on the pigment-producing action of R^r in the offspring of R^rR^{1st} heterozygotes.

A test was made to determine whether mutations of R^{st} and R^{1st} to R^{sc} are associated with transpositions of a genic element away from the R locus. The test gave a negative result but did not exclude the possibilities that the transpositions are to sites close to the R locus, or that the transposed element has no observable effect on the expression of R^{st}.

Microfilm $2.00; Xerox $3.00. 60 pages.

ADRENAL TUMORS AND OTHER PATHOLOGICAL CHANGES IN RECIPROCAL BACKCROSS MICE. I. BACKCROSS TO STRAIN CE.

(L. C. Card No. Mic 58-7639)

Margaret McQuiston Dickie, Ph.D.
Brown University, 1958

Study of postcastrational changes in several inbred strains of mice has shown that some strains do not compensate and other strains compensate to varying degrees following an injury to the endocrine homeostasis, with development of pathological changes in the adrenal glands. The structural changes in the adrenals are accompanied by biochemical changes, i.e., the abnormal adrenals produce sex steroid hormones that are capable of stimulating the accessory reproductive organs. The type of compensation is constant for each strain, indicating that the potential for compensation is under genic control.

A series of genetic tests have been designed to elucidate the genic control of the postcastrational changes. The first test was the examination of a series of F_1 reciprocal hybrids of some of these inbred strains. Even though certain strains may compensate identically (phenotypically), F_1 hybrids of any one of these strains crossed with a different strain reveal some potentials of the parental strains that may have been suppressed in the parental environment but are operative in a new environment. The hybrid potential is not always intermediate between the parental types but may be cumulative so that there appears to be overcompensation (heterosis).

The second genetic test, investigated in this dissertation, has been the study of another generation, reciprocal backcrosses of certain hybrids to one parental strain. F_1 animals of DBA/2WyDi♀ x CE/WyDi♂ and the reciprocal F_1 were mated with strain CE females and males. Approximately 780 animals were sacrificed for the study. Two experimental methods have been used throughout these investigations, one is the operative technique of gonadectomy 1-3 days after birth and the other is histological

classification of the pertinent endocrine glands and related accessory reproductive organs at specified ages from 2-24 months.

The results of primary interest are as follows: 1) 93% of the gonadectomized animals had adrenal cortical carcinomas (complete compensation), 6% had nodular hyperplasia of the adrenals (intermediate compensation), and 1% had no adrenal post-castrational alterations; 2) 20% of the adrenal tumor animals also had basophile adenomas of the anterior pituitary (over-compensation); 3) 26% of the gonadectomized females and 20% of the intact virgin females had uterine hyperplasia; 4) 64% of the virgin females 20-24 months of age had ovarian tumors; 5) analysis of variance of various organ weights indicated that age had a significant effect on body weight, thymus, and adrenal weights; maternal influence had a significant effect on body weight and kidney weight; all weights were significantly different in the two sexes; phenotype interaction with sex and age had a significant effect on adrenal weight. The suggested explanation of this is that the gene for full color (C) which allows expression of other color genes is responsible for the difference in adrenal weights in the extreme dilution and black agouti phenotypes. This backcross generation then reflects the segregation (and various recombinations) of the parental and hybrid potentialities for compensation and has the whole spectrum of compensatory potentialities from no compensation to over-compensation.

Using this evidence, a scheme for the genic control of this endocrine system, the gonad-adrenal-pituitary (GAP) triangle, has been proposed. This concept of compensation in the control system, the GAP triangle, is dependent upon the interactions of at least five polygenic loci. Two of these polygenic complexes are primary, one controlling the general susceptibility or potential of the organism to compensate and the other controlling the normal regulation and interaction of the GAP triangle. In addition there are three specific complexes which are revealed particularly if an imbalance in the GAP triangle occurs. These three complexes, acting directly and specifically on the adrenals-gonads, the pituitary, and the accessory reproductive organs, determine, within the limits of the first two complexes present, the quantity and quality of compensation there shall be in the control system, the GAP triangle. Minimum gene number estimates can be made, and on the basis of present backcross data are suggested in two of the complexes, i.e., at least 4 P complex (pituitary complex) factors appear to be necessary for pituitary tumor formation in the gonadectomized animals, and at least 4 AR (accessory reproductive organ) complex factors appear to be necessary for development of uterine hyperplasia. However, the expression of these two conditions cannot be isolated from the rest of the control system. They therefore depend not only on these complexes themselves for expression but also on the amount of the adrenal-gonad complex that is operating, and all of them depend upon the amount of susceptibility and endocrine regulation factors present in the genome. Microfilm $2.00; Xerox $5.60. 115 pages.

STUDIES ON LIFE CYCLES OF BLOOD-INHABITING PROTOZOA WITH REFERENCE TO THEIR PHYLOGENETIC SIGNIFICANCE

(L. C. Card No. Mic 58-5144)

Melvin Harris Goodwin, Jr., Ph.D.
Emory University, 1956

A study was made of haemogregarines in reptiles collected primarily from southwestern Georgia. Objectives of this investigation were: (1) to determine the variety and distribution of haemogregarines in the local fauna, (2) to explore the possibility of delineating characteristics that would enable identification of organisms on the basis of forms found in peripheral blood, (3) to conduct studies on the life cycles of significant species, and (4) to develop and summarize information on the phylogenetic relations of the haemogregarines to blood-inhabiting Protozoa.

In the survey of indigenous reptiles, examination of Giemsa-stained blood films revealed 117 infections of haemogregarines in 808 specimens. Sixty-seven of 118 snakes, 11 of 14 species, were found with haemogregarines in the peripheral blood. Similar data for turtles are: 46/84 individuals, 8/10 species; and for lizards: 4/606 specimens, 1/5 species. The small number of specimens examined and the sporadicalness of collections precluded analyses of the survey data to determine seasonal distribution of infections or the incidence of parasites in the various species.

The forms of haemogregarines found in the peripheral blood of the lizard (Sceloporus u. undulatus) were different from related parasites found in other reptiles. Parasites in the lizards were all variants of a single stage, later shown to be the sporozoite, while in other reptiles apparently more than one stage occurred in circulating erythrocytes. The size of forms in the lizard usually varied from 5 by 3 to 10 by 5 microns. Cytological features were not distinctive; chromatic material varied in shape, distribution, and intensity of staining. Forms of haemogregarines in snakes and turtles were of two general types, but intermediate forms indicated that variations were due to differences in stages of development. The larger elliptical, or bean-shaped, forms of the parasite, generally with scattered basophilic granules and chromatin in the form of strands or amorphous aggregations, were identified as the schizogonous stages. The smaller forms with comparatively compact nuclei and sparse chromatin were identified as young schizonts. Variations in size between these forms were less than that observed of the same stage in different hosts. The parasites were about 15 microns long by 3 to 5 microns wide.

Progressive stages in growth of the young parasite were characterized by an elongation and doubling upon itself to form a U-shaped object within the corpuscle. As the nucleus became less compact and chromatin began to orient in strands or clumps, the newly-formed recurved limb was gradually resorbed, and the width of the parasite increased. The most advanced stages of schizonts observed in peripheral blood had completely differentiated segments of chromatin. Mature schizonts have been observed rarely in the peripheral blood. According to previous studies, mature schizonts are found only in the deep tissue, e.g., bone marrow, liver, or lung.

An analysis of morphological characters of parasites observed in the peripheral circulation failed to disclose

consistent, distinguishing features that would enable identification of individual infections or groups of haemogregarines. From the present study and reports of previous investigations, it appears that at least some knowledge of the life cycle is necessary before haemogregarines can be assigned with certainty to the proper genus. On the basis of occurrence of polymorphic forms in erythrocytes and other similarities to adequately described organisms, most, if not all, of the haemogregarines of snakes and turtles examined in this study appear to belong to the genus Haemogregarina.

The haemogregarine of the lizard was referable to Hepatozoon, Karyolysus, or Schellackia on the basis of features reported for these genera. Results of transmission experiments showed, however, that infections were transferable between lizards by injection of blood containing parasites. This indicated that forms of the parasites other than gametocytes were present in peripheral blood. Since only sexual forms are usually found in the circulating blood of Hepatozoon and Karyolysus, the tests directed attention to other genera for placement of the saurian haemogregarine. Spontaneous transmission of this parasite in the laboratory following an infestation of lizard mites (Geckobiella texana) suggested that this common natural ectoparasite of lizards might be the normal vector. Subsequent controlled laboratory experiments showed that the haemogregarine could be transmitted by external exposure of infected lizards to mites which had engorged on an infected lizard, by feeding similarly engorged mites to susceptible animals, by injection of blood containing parasites, and by feeding of blood, liver, or lung from an infected animal. Infections were not produced by internal or external exposure of lizards to the progeny of mites that had fed on infected lizards. This information further militated against consideration of relationship of the parasite of Karyolysus.

Examination of tissue from lizards infected experimentally with the haemogregarine disclosed Coccidia-like stages in the epithelium of the midgut but not in other organs. By application of isolation procedures and suitable experimental controls, the possibility of simultaneous infection with an intestinal coccidian having a freeoocyst stage was eliminated. On the basis of histological studies and transmission experiments, a cycle of development was interpreted which corresponded with that described for Schellackia. The process is initiated when infections are acquired by lizards feeding on mites containing sporozoites. These stages are released in the gut of the lizard where the parasites invade the epithelial cells. Schizonts develop and the resulting merozoites are discharged into the lumen of the gut and invade other epithelial cells. Eventually merozoites are produced that develop into gametes which form a zygote in the subepithelial tissue, This develops into an oocyst containing sporozoites that are subsequently released, penetrate capillaries and invade erythrocytes. The sporozoites are ingested with the blood when a mite feeds on the lizard. In the mites, sporozoites are released as the erythrocytes are digested and the parasites accumulate in the epithelial cells of the intestine of the mite. Sporozoites undergo no further development in the mite. The close similarity of the cycle of Schellackia to that of an intestinal coccidian is apparent.

The relations of the haemogregarines to the Coccidia were recognized by some of the early workers and a rich literature developed on this subject. Availability of local representatives and firsthand observation of a primitive cycle provided the stimulus for assembling this information and viewing it in relation to observations and interpretations of earlier workers. The present work enabled some augmentation of these concepts, and having the advantage of many substantial contributions since the previous synthesis, it was possible to substantiate and illustrate more fully the probable pathway in the development of blood parasitism by the Sporozoa.

Apparently, extant blood-inhabiting Sporozoa developed by parallel evolution along two general lines. One course leads from intestinal Coccidia originally parasitic in vertebrates: Schellackia and Lankesterella are considered representatives of this process. As indicated above, the entire development of Schellackia takes place in the epithelium of the gut and no progressive stages are passed in the vector. The cycle of Lankesterella is similar, except that development occurs in the endothelium of blood vessels. The removal of the site of development to tissues further from the gut is regarded as an advancement in parasitic adaptation. The second course was followed by intestinal Coccidia of invertebrates that adapted to existence in the blood of vertebrates. The genera Haemogregarina, Karyolysus, and Hepatozoon among the haemogregarines and genera of Haemosporidia, e.g., Plasmodium and Haemoproteus, followed this pathway. These parasites evolved from forms which had intratissue stages in the invertebrates and became adapted to vertebrate blood cells when injected by blood-feeding invertebrates. Progressive stages are indicated by forms which have a greater number of stages in the blood cells of vertebrates. Many examples suggest secondary adaptation of vectors in this process.

The haemogregarines are highly significant in development of blood-parasitism and studies of these organisms should continue to provide further data on the process of ecological adaptation of parasitic organisms. This information has considerable intrinsic importance to biology as well as to better understanding of pathological processes and rationales of remedial measures.

Microfilm $2.00; Xerox $5.80. 117 pages.

AN ANALYSIS OF GENETIC SYSTEMS IN WHICH THE PHENOTYPE DEPENDS UPON DEVIATIONS FROM AN OPTIMUM

(L. C. Card No. Mic 59-341)

Ken-ichi Kojima, Ph.D.
North Carolina State College, 1958

Supervisor: C. Clark Cockerham

The basic structure of the optimum model is that the value of the phenotype depends on the squared deviation of the value given by primary gene action from an optimum value. A smaller deviation results in a larger value of the phenotype.

In the present study no epistasis was assumed in primary gene action. As a source of environmental complication, heterogeneous optimums were introduced for different macroenvironments. Such an optimum model had the following properties:

1. Given a certain degree of dominance in primary gene action, the phenotype exhibits varying levels of dominance as a function of the optimum and gene frequencies.

2. The phenotypic effects due to epistasis among more than two loci do not exist as long as the primary gene action is additive between loci.

3. The effects of genotype by environment interactions on the phenotype consist of interactions of additive and dominance effects of the primary gene action with the heterogeneous values of the optimum.

The total variance in the genetic system was partitioned according to various sources of variation. To derive the expressions of components of genotypic variance for an arbitrary genetic model, a new method was developed for a random mating population with two alleles per locus. This method requires that the mean of the population be written as a function of gene action which is partially differentiable with respect to any set of gene frequencies.

After the analysis of variation was completed for the optimum model, the change in population mean due to mass selection was studied. Special emphasis was placed on deriving the expected change in the population mean when the population was subdivided into small groups, one for each macroenvironment, and when selection was within each macroenvironment.

Secondly, the conditions for an equilibrium to be stable under mass selection were investigated. This study made clear that there could be stable equilibria with non-trivial gene frequencies for all loci in the optimum model. Some numerical examples for the model with two loci were presented by use of Wright's adaptive surface.

Finally, the expressions of covariances between relatives occurring in the same macroenvironment and in different macroenvironments were obtained. The former are linear functions of the components of genotypic variance as well as of variance due to interactions of genotypes by environments. The latter are of genotypic variances only. These covariances were used to formulate possible estimators for the components of genotypic variance and genotype by environment interaction variance.

Biases due to interactions of genotypes with environments as well as to epistasis in estimates of additive and dominance variances were not generally proportional to the respective variances defined over all environments for the optimum model.

Microfilm $2.00; Xerox $4.40. 84 pages.

THE EFFECT OF CHELATION ON X-RAY INDUCED STERILITY, DOMINANT LETHALS, AND FREQUENCY OF CROSSING-OVER IN HABROBRACON

(L. C. Card No. Mic 59-347)

Leo Emery LaChance, Ph.D.
North Carolina State College, 1958

Supervisor: Dr. Daniel S. Grosch

In a series of experiments, four groups of virgin wasps comprising 1) controls, 2) EDTA-fed, 3) X irradiated, and 4) EDTA-fed and X irradiated, were compared to study the effect of these treatments on adult life span and the reproductive tissues.

Whereas, the low doses of irradiation have no effect on life span of females, the feeding of a chelating agent significantly reduced the life span of the females below that of controls. This was observed in all experiments.

The ingestion of a chelating agent prior to irradiation resulted in an increase in the percentage of induced dominant lethals in the embryos. The increase in dominant lethals was greater than in groups given either a chelating agent or X radiation alone. Evidence of synergistic action of the two treatments is presented. The enhancement of the radiation effect was noted in both oocytes and oogonial cells. Discussion centers around the role that chelation of metal ions plays in increasing the amount of damage scored subsequent to radiation.

After a radiation dose of 2500 r, Habrobracon females undergo a period of temporary sterility followed by a period of marked recovery in egg production. EDTA ingestion prior to irradiation reduces the amount of recovery observed. The productivity in terms of larvae per female per day is significantly reduced and evidence of synergistic action of the two agents is presented.

Cytological study of wholemounts of dissected ovarioles showed a degree of damage and degeneration in ovarioles which is attributed to the action of the chelating agent. The anomalies observed in ovarioles include disruption of the developmental sequence and indicate considerable resorption of damaged gametes.

In a study of recombination between three linked loci it was found that feeding with EDTA caused a significant increase in crossing-over in those cells which were postsynaptic at the time of treatment. No effect was demonstrated for gonial cells. Possible modes of action of chelating agents on genetic material are discussed.

Microfilm $2.00; Xerox $4.40. 82 pages.

SOME EFFECTS OF INBREEDING WITH SELECTION ON MILK YIELD AND GROWTH IN MILK GOATS

(L. C. Card No. Mic 59-552)

Emmett Ezekiel Ormiston, Ph.D.
University of Illinois, 1958

The objective of this study was to investigate the nature of the effects of intensive inbreeding on a superior foundation stock of milk goats when the inbreeding was combined with selection for milk yield only. The data included the milk and butterfat production records of forty-two does and the measurements of height at withers and body weight at two and ten months of age on fifty-two female kids in the University of Illinois herd of registered French Alpines.

The regressions of the production characteristics, milk yield, butterfat yield and butterfat percentage on the coefficient of inbreeding were tested for both curvilinearity and linearity on the bases of within-sire maximum likelihood, within-sire, within-year, over-all maximum likelihood and over-all analyses. The regressions of the growth characteristics, height at withers and body weight, on the coefficient of inbreeding were tested for both curvilinearity

and linearity on the bases of within-sires, within-years, and over-all analyses.

Inbreeding with selection did not deleteriously affect either production or growth. The curvilinearity of the regressions of milk yield and butterfat yield on the coefficient of inbreeding approached significance or was significant at the 0.05 level of probability, and the regressions showed no evidence of being negative. The predicted level of milk production reached its minimum at a coefficient of inbreeding of 0.20 to 0.25. Inbreeding did not significantly affect the butterfat percentage.

The behavior of genetic action when inbreeding was combined with selection in this study provides further evidence that many genes affect milk and butterfat yield and that they are largely additive in their action and closely associated. The regression of height at withers on the coefficient of inbreeding showed evidence of curvilinearity and suggests that in selecting for milk yield unconscious selection for skeletal size was made simultaneously.

The estimated repeatability of the corrected 240-day lactation records for goats in this study was found to be 0.631 for milk and 0.658 for butterfat. Based on records adjusted for environmental changes by the principle of maximum likelihood the correlation between the milk yield of fourteen dams and that of their twenty-seven daughters was 0.265 and the estimated heritability of milk yield was 0.52. These values indicate a close similarity between the behavior of the genes responsible for milk and butterfat yield in milk goats and in dairy cows.

Microfilm $2.00; Xerox $4.20. 76 pages.

DETERMINANTS OF MATING TYPE IN ESCHERICHIA COLI

(L. C. Card No. Mic 59-1408)

Alan A. Richter, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Joshua Lederberg

Mating type in Escherichia coli is determined by a factor, F, which is fixed to the chromosome in Hfr males, behaves as an infectious particle in F+ males, and is absent from females. Different Hfr types are determined by the position of the factor on the chromosome.

A strain is described which changes reversibly at a high rate from a specific Hfr type to the F+ state. It was found that the determinant of enhanced rate of change is itself the chromosomal site of the factor in the Hfr state. Thus, the movement of the F factor to and away from the chromosome is controlled by the locus to which or away from which the factor moves. This movement may be termed episomic alternation. The determinant of enhanced rate of change may be thought to act by increasing the frequency of events in its neighborhood which allow for the fixation and release of the F factor. Such events may be considered to occur with a low frequency at other chromosomal sites.

The F factor is shown to undergo reductive infection, a process analogous to lysogenization. In addition, the F factor may transpose from one chromosomal site to a second chromosomal site. This property suggests a relationship between the F factor and the controlling elements of maize. The intrinsic property which these hereditary determinants share is the tendency to undergo a cycle of attachment to and detachment from a chromosomal locus.

In the second part of the thesis, a tentative linkage map of Escherichia coli is presented. In particular, evidence for and against the linkage of Gal to S is presented. This bears on the question of the circularity of the chromosome.

Microfilm $2.00; Xerox $4.00. 73 pages.

THE ORGANIZING ROLE OF THE LIMB BUD ECTODERM IN INTRAPOUCH EMBRYONAL TRANSPLANTS IN THE HAMSTER (MESOCRICETUS AURATUS)

(L. C. Card No. Mic 58-3122)

Thomas Edward Smith, Jr., Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor Donald I. Patt

The potential usefulness of the membranous cheek pouch of the hamster as an investigative tool in experimental embryology has been explored. After preliminary studies involving the transplantation of ova, morulae, and various embryonal tissues, the anterior limb buds of embryos in the eighth to eleventh day of development were chosen for intensive study.

Ova or embryos were removed after unilateral hysterectomy and implants were made subepidermally into a "pocket" prepared in the richly vascular connective tissue of the cheek pouch of the host. Mothers, metestrus females, and males were used as hosts, with no apparently significant difference in receptivity or subsequent course of differentiation of the implants. Preimplanatation stages failed to grow, but when, in an effort to approximate in utero conditions, uterine endometrium was transferred with either pre- or post-implantation stages, endometrial growth in the pouch ensued. The cytoarchitecture of the endometrium and the associated submucosa and myometrium which had been transplanted along with it was remarkably like that of their normal counterparts in the intact uterus.

Explantation of pieces of embryos to the cheek pouch demonstrated that derivatives of all three primary germ layers would undergo both differentiation and morphogenesis in this site.

The unmodified limb bud underwent marked regulative development when explanted to the cheek pouch. When the pre- and post-axial and apical ectoderm were removed in an attempt to demonstrate the possible interdependence of ectodermal and mesodermal components of the limb bud, regulative development was interrupted. The later in limb bud development that this separation was effected, the smaller was the proportion of non-regulative growth, with nine and one-half days representing the time before which little or no regulative growth was obtained. Investigation of tissue alkaline glycerophosphatase during the course of differentiation of the explanted buds in the cheek pouch site showed appreciably increased activity of this enzyme occurring as morphogenesis and differentiation of the anlagen went forward.

Limb bud ectoderm was shown to be unable to induce

non-limb bud mesenchyme to form a limb. A second inductor system, one which operates between neural tube and dorsal sclerotome, influencing the differentiation of vertebrae, was also shown to exist in the hamster.

Microfilm $2.65; Xerox $9.20. 204 pages.

CYTOGENETIC STUDIES OF THE F_1 HYBRID AND HYBRID DERIVATIVE OF TWO PHALARIS SPECIES

(L. C. Card No. Mic 59-777)

James Lyne Starling, Ph.D.
The Pennsylvania State University, 1958

A cytogenetic study was made of the F_1 hybrid, Phalaris arundinacea L. x Phalaris tuberosa var. stenoptera (Hack.), the doubled hybrid derivative, and of the parental species. Consideration was given to the possible practical value of the study in Phalaris breeding.

Superior clones of the parental species were selected from nurseries at University Park, Pennsylvania. Winter hardiness was the principal criterion of selection in the case of P. tuberosa.

Selfing and crossing of plants in the greenhouse established that a high degree of self sterility was typical of both parental species, and that interspecific crosses were easily obtained by bagging flowering panicles of each species together without emasculation. Approximately 15 per cent of all seedlings established from seeds set in the P. arundinacea x P. tuberosa crosses were identified as hybrids. No hybrids were identified among the progeny of P. tuberosa clones in attempted reciprocal crosses.

Hybrids were in general morphologically intermediate to their parental clones, although a wide range of variability was noted in height and vigor. As seedlings, hybrids tended to resemble P. tuberosa but became more intermediate in appearance as plants matured. Under greenhouse conditions, hybrids extruded anthers but normally did not dehisce. Survival of spaced plants in a field nursery indicated that hybrids possess the winter hardiness characteristics of P. arundinacea.

The predominant diakinesis association of chromosomes in both parental species was confirmed to be 14 bivalents. Quadrivalents were identified in eight per cent of the P.-M.C.'s analyzed in P. tuberosa, but in a much smaller percentage of cells in P. arundinacea. Stickiness was strongly expressed in certain clones of P. arundinacea, but differed in its degree of expression among clones. From the nature of associations at pachytene and on the basis of staining reaction of attenuated strands often joining bivalents, it is suggested that attraction between heterochromatin blocks rather that multiple homology accounts for stickiness as expressed in these species.

Meiosis was studied in eight hybrid clones representing five crosses among different parental clones. Significantly different pairing relationships were observed at diakinesis among the several hybrids. Considering all clones, the mean bivalent frequency per P.M.C. ranged from 4.25 to 12.12, and the frequency of univalents ranged from 1.14 to 14.50. At least one quadrivalent was identified in from 12.50 to 88.46 per cent of the P.M.C.'s of the various clones. Trivalents were seldom identified. Eliminating certain clones whose behavior was thought to principally reflect extreme environmental influences, the average diakinesis association was approximately two univalents, eleven bivalents, and one quadrivalent. Stickiness and non-disjunction were occasionally expressed.

All hybrid clones were typified by precocious movement of chromosomes to the poles at metaphase I. A higher mean frequency of univalents per P.M.C. apparent at metaphase than was observed at diakinesis suggested that desynapsis of chromosomes previously in association occurred.

Laggard chromosomes were apparent at both anaphase I and II in hybrid clones. Bridges with associated acentric fragments were identified in approximately 14 per cent of all anaphase I cells, and bridges were detected in 3.8 per cent of all anaphase II cells. Micronuclei were observed in the majority of pollen quartets in hybrid clones. For all hybrids, less than seven per cent of the pollen grains were judged to be functional on the basis of stainability. Backcrosses to P. tuberosa indicated essentially the same degree of fertility in the female gametes.

The presence of the following structural differences between chromosomes of the parental species was established from study of pachytene configurations: two or more inversions, one or more deletions, and two or more translocations or other multiple homology involving all or large segments of chromosomes.

Fifty-six chromosome amphiploids were induced from the F_1 hybrids by colchicine treatment. The predominant diakinesis association of chromosomes in the doubled derivative was bivalent. The presence of anaphase bridges and fragments, as well as precocious metaphase disjunction, suggested that allosyndetic pairing continued after chromosome doubling.

Relative merits of several approaches to restoring fertility to the hybrids are presented.

Microfilm $2.00; Xerox $4.60. 87 pages.

AN INVESTIGATION OF THE MECHANISM OF ACTION OF MALEIC HYDRAZIDE IN TOBACCO AND OTHER PLANTS

(L. C. Card No. Mic 59-339)

James Earl Baker, Ph.D.
North Carolina State College, 1958

Supervisor: Herbert Temple Scofield

An investigation of the effect of MH on various metabolic systems of plants has been conducted in order to evaluate certain ideas concerning the mechanism of its action on plant growth and to obtain additional information. It was observed that inhibition of respiration of tobacco axillary-bud tissue and tobacco seedlings was produced by high concentrations (0.009 to 0.027 M) of MH. The effect was enhanced by lowering the pH of the medium to 4.0 thereby corroborating the findings of others.

Investigations were made on the effect of MH on the activities of various respiratory enzymes. The prevalent notion that MH inhibited dehydrogenase activity was not substantiated with any of the dehydrogenases studied, viz. glucose-6-phosphate dehydrogenase, isocitric dehydrogenase, TPN-malic dehydrogenase, and succinic dehydrogenase. Other respiratory enzymes which were not inhibited by MH (0.01 M and greater) were hexokinase, pyruvate kinase, polyphenol oxidase, ascorbic acid oxidase, cytochrome c reductase, and cytochrome oxidase. The enzyme diaphorase which can catalyze the reduction of cytochrome c in the presence of reduced pyridine nucleotides and quinones, was inhibited by concentrations of MH which likewise can inhibit respiration of certain plant tissues. The possibility that diaphorases are involved in electron transport of these tissues was discussed. Other enzymes not involved in respiration which were studied and which were not affected by high concentrations of MH were nucleosidase, glutamyl transferase, and DPN-ase.

The possibility that MH inhibits certain other metabolic systems was investigated. The energy-storing mechanisms of oxidative and photosynthetic phosphorylation of plants were not affected by high concentrations (0.01 M) of MH under the conditions used in these studies. Another system, viz. the incorporation of C^{14}-glutamate into the proteins of pea and tobacco root particles was studied and no inhibitory effect of MH at 0.01 M, either in the presence or absence of nucleosides, was observed. It was concluded that any inhibition of protein synthesis which might be exerted by MH must come about through an inhibition of some process other than the direct incorporation of amino acids into protein.

A binding of MH as the diethanolamine salt to proteins and RNA in vitro was observed. The binding of MH to these macromolecules was shown to be less if MH was in the form of the potassium salt. Extracts from plants treated with the labeled materials could be fractionated with ammonium sulfate and the fractions were observed to be radioactive. The radioactivity was not readily dissociated by overnight dialysis against water or non-labeled MH. The amount of radioactivity associated with the salt fractions from plants treated with the labeled MH as the diethanolamine salt was greater than from those treated with the potassium salt. This indicated that at least a portion of the MH remained in the form of the diethanolamine salt in the plant. The possibility that the binding of MH to proteins might be of significance in the eventual explanation of the interaction of MH with auxins was considered.

Microfilm $2.00; Xerox $5.40. 110 pages.

AN ECOLOGICAL STUDY OF SPANISH MOSS (TILLANDSIA USNEOIDES L.) WITH SPECIAL REFERENCE TO GROWTH AND DISTRIBUTION

(L. C. Card No. Mic 58-5142)

Richard Edwin Garth, Ph.D.
Emory University, 1954

An investigation of the growth and distribution of Spanish moss (Tillandsia usneoides L.) was conducted at Emory University and the Emory University Field Station, Newton, Georgia, from January 1952 to May 1954.

The objective of this study was to investigate (1) the rate and pattern of growth, (2) the effect of selected factors on this growth, (3) the present distribution in the United States, (4) the specific distribution in a limited area, and (5) the causes for these distribution patterns. Certain observations also were made concerning the life cycle, particularly with reference to sexual reproduction. In addition, if Spanish moss was determined to be directly dependent upon climatic factors in its growth and distribution, then the possibility that the response of the plant would have use as an indicator of these conditions was to be explored.

The growth pattern is one of alternately dominant dichotomous forking (scorpioid dichotomy). The non-dominant branch at each fork is a leaf. The flowers are terminal on the pendent plants and flowering in south Georgia occurs from the middle of April to the first of June. The subsequently formed capsule remains for six months and its remnants remain in the same position for a year. Terminal growth of the plant occurs from this point and is easily identified and measured.

Spanish moss has a positive geotropic response. Gravity alters the normal growth pattern when the plant is in a horizontal position, rather than the normal, which is vertical. The plant reacts by developing side branches at the nodes. Horizontal positioning occurs in nature when ends of the plant are blown by the wind into some other branch and become entangled. The extent of consequent lateral branching was investigated with plants laced to the arms of pin-wheels. These pin-wheels had eight arms, each

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forty-five degrees apart and fifteen centimeters long. The plants on the lateral arms had a considerably higher percentage of lateral branches and more lateral leaves than the vertical plants. This is a method of vegetative reproduction, since the old horizontal stem eventually dies, leaving, in effect, several new plants hanging from it.

The effects of visible solar radiation were investigated by growing plants under seven shade racks which were covered with various thicknesses of cheese cloth. Observations indicated an almost direct relationship between terminal growth and the percentage of full summer solar radiation. Terminal growth below sixteen and one-half per cent of full solar radiation was suboptimal. From this standpoint, plants growing in densely shaded places are living under suboptimal conditions.

The effects of rainfall and other sources of moisture were investigated. Fifteen asphalt-coated wire baskets were filled loosely with Spanish moss. Twelve were covered with a plastic screen and three were not covered. Three of the covered baskets were placed over a swamp and were not watered, having only high atmospheric humidity as a moisture source. The remaining twelve were placed under a grove of oaks. Three were watered ten times per week, three watered five times per week and the remaining six, including the uncovered ones, were not watered. The plants which were watered ten times per week grew nearly twice as much as any of the others. The others however, could not be statistically separated from each other. Thus, very frequent rains are necessary for optimal growth.

An additional moisture observation was made by placing several festoons of plants on a screened-in porch. These showed no signs of terminal growth after three months and died after this period. They were not watered, but the relative humidity was fairly high, varying between forty and ninety-five per cent. This was insufficient to sustain the life of the plant.

A portion of Baker and Early Counties in southwest Georgia was mapped in detail as to the location of Spanish moss. In all but two of the one hundred and fifty-six cases the Spanish moss was confined to the perimeter of ponds containing mature cypress trees. These two areas had not been either heavily burned or lumbered. Here the epiphyte extended to the limits of tree growth. There were many apparently suitable ponds in the area which did not have any Spanish moss associated with them.

One pond in this area which did have a large amount of Spanish moss around it was Mossy Pond. A transect was made, beginning at the edge of the pond, in terms of different habitats where the plant was growing. Seven stations were used including extremes and intermediates of hydric, mesic and zeric habitats. These stations also varied in terms of abundance of Spanish moss. All stations, except one at 15.2 meters, were located about 4.7 meters above the ground. Each was centered around an instrument board which supported a Taylor maximum-minimum self-registering thermometer and two Livingston atmometers, one black and one white.

After a period of seventeen weeks, sixty plants were measured at each station in terms of terminal growth. All plants showed some growth, but the plants at the pond edge grew the least. These were statistically different from all the others. The remainder were inseparable among themselves. The temperature and atmometer readings from this period did not show any specific correlation with growth, indicating that these at least were not primary limiting factors with respect to growth. Spanish moss was heaviest at the pond edge where it grew the least. Repeat collections were made at lower levels at selected stations and these lower levels showed less growth than the higher ones. The vertical differences appeared to be a result of increased shading and it is suggested that this may also explain the poor growth at the pond edge where the trees were more dense. Thus, the pond does not appear to hold any benefits for Spanish moss in terms of temperature or relative humidity and the heavy growth of trees at its edge adversely affect the plant due to excessive shading.

Spanish moss does not seem to have any specific host which it occupies more than any other. This plant however, is not often found in young pines. Three possible reasons for this are suggested. First, pines are self-pruning and the plant is lost with the branches. Secondly, the leaves of a pine present a formidable barrier to the entrance of wind-borne portions of the epiphyte. Thirdly, there may be a differential in the amount of rainfall interception between the needle-leaved species and the broad-leaved species. This would greatly affect the amount of moisture available to Spanish moss.

Seeds were successfully germinated in the spring of 1954. Initially, groups were precooled at -29° C., 1° C. and 4° C. for forty-eight hours and all groups, as well as the controls, germinated. The seeds were placed on pieces of bark on the ground after the treatment and many were washed away by rain or blown off by the wind. Approximately thirty per cent remained at the end of two months and all of these germinated.

No biotic enemies were observed which appeared to seriously affect the present range of distribution. Caterpillars were observed to eat the young shoots, but were seen only on two occasions.

Separate collections of Spanish moss from two cypress trees were made at Putney Pond, located in the northeast portion of Baker County, Georgia. One of these was at the edge of the pond and the other was about forty-five meters away. All other trees had been removed several years previously. The plants taken from these trees were not separable statistically in terms of terminal growth.

The information gained from several of these experiments indicated that the pond holds no specific advantage for the plant in terms of relative humidity or temperature. On the contrary, the heavy growth of trees around the pond edge, while affording many sites for the epiphyte, is disadvantageous to the plant due to heavy shading.

In spite of these data, a plant-pond relationship does exist, not as a result of climatic conditions, but probably due indirectly to the results of fire and lumbering. The ponds having the greatest amount of Spanish moss were those which have been unaffected by fire and lumbering. These two forces do not touch the cypress trees growing in the water. It is suggested here that these trees act as reservoirs from which the plant can spread following the action of these two destructive forces over the dry areas. The plants thus are heaviest at the pond edge where the first trees appear. Later they spread out as suitable new substrates are available.

Spanish moss in the United States is limited to the Coastal Plain of the southeastern states, ranging from Texas to Virginia. The distribution within this area was plotted by counties from all available data. No correlation with climatic or physiographic data, however, was

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

found. This distribution seems to be a possible result of the major storm paths which cross this area, all either arising in, or passing through Mexico and southern Texas. These storm paths, in general, pass in an easterly direction across the Coastal Plain and leave the continent near northern Florida or peninsular Virginia. The plant occurs in northern Mexico and could have been carried into the United States from this point. Other plants could have been brought into Florida from islands in the Caribbean by tropical hurricanes.

This epiphyte is able to survive outside of the Coastal Plain. Several festoons of the plant have successfully survived for five years in the mountainous northeastern portion of Georgia at Toccoa. In connection with this investigation other plants were sent there at the time of flowering and these produced viable seed.

The distribution of the plant appears to be essentially fortuitous and not the result of any climatic factor.

Microfilm $2.00; Xerox $6.00. 124 pages.

ETIOLOGY AND EPIPHYTOLOGY OF STALK ROT OF CORN IN PENNSYLVANIA

(L. C. Card No. Mic 59-763)

Graydon Chapman Kingsland, Ph.D.
The Pennsylvania State University, 1958

The purpose of this investigation was to study the fungi associated with corn stalk tissue from seedling stage to maturity, to determine the seasonal range of their occurrence, and to evaluate their relationship with the degeneration of the stalk commonly referred to as stalk rot. The study embraces that part of the 1955 season from July to October and the complete growing seasons of 1956 and 1957.

Isolations of fungi from all portions of seedlings and mature plants revealed Fusarium moniliforme to be the most prevalent fungus in 1955. In 1956 Fusarium moniliforme var. subglutinans was isolated more frequently than any other fungus, F. moniliforme dropping to second rank in total number of isolations. During 1957 no isolations of F. moniliforme were obtained, whereas F. moniliforme var. subglutinans was isolated most frequently. Gibberella zeae was not isolated in appreciable frequency during either 1955 or 1956, the majority of isolates being obtained in the fall. This fungus increased appreciably in number of isolates obtained during 1957, accounting for 33 per cent of the total.

Fusarium moniliforme and its var. subglutinans were isolated from seminal roots, adventitious roots, crowns, node tissue, rudimentary ears, and from leaf tissue throughout the seasons. Fusarium moniliforme var. subglutinans was obtained from areas adjacent to corn borer galleries during 1957. Gibberella zeae was not isolated from seedling tissue or from root tissue in any year. Its presence was demonstrated in leaf and node tissue and in rudimentary ears and ear shanks. In the light of these results, it is suggested that the fungi responsible for stalk rot enter the plant via rudimentary ears, leaf tissue, and crowns.

Although F. moniliforme and its var. subglutinans were found associated with corn all during the growing season, symptoms of stalk rot occurred only in the fall, usually beginning in mid-September.

On the basis of preliminary field observations it is suggested that temperature may modify the host-parasite relationship and may be important in determining which fungi are prevalent from year to year. Fusarium moniliforme grew more rapidly in linear diameter on culture media at 35° C. than did F. moniliforme var. subglutinans or G. zeae. The difference in growth was not as great when these 3 fungi were compared on the basis of dry weight of mycelium. Fusarium moniliforme grew equally well at 25° and 30° C. The optimum for G. zeae and F. moniliforme var. subglutinans was 25° C. Considerable variation was observed to occur between specific isolates of each fungus at all 5 temperatures studied.

Diplodia zeae, reported to be a major stalk rot incitant in many corn growing areas, was not isolated during the course of this work.

Introduction of G. zeae, F. moniliforme and F. moniliforme var. subglutinans into pasteurized soil, in which 2 hybrids and two inbreds were planted, revealed that only G. zeae was responsible for seedling blight. No isolate of F. moniliforme or its var. subglutinans reduced the dry weight of seedlings significantly more than the non-inoculated control plants.

Field inoculation of Pennsylvania hybrid 444 with G. zeae, F. moniliforme, and F. moniliforme var. subglutinans revealed that all 3 fungi were capable of causing stalk rot. Fusarium moniliforme var. subglutinans caused less stalk rot than either of the other 2 fungi. All 3 fungi caused less rot when inoculated in September than when inoculated in August.

Histological investigations revealed that mycelium of G. zeae is primarily intercellular during early stages of infection. During subsequent periods it is capable of penetrating cell walls and growing intracellularly. Gibberella zeae was not observed in the vascular system, but it did cause disintegration of the fundamental parenchyma tissue. Fusarium moniliforme, on the other hand, was observed to enter xylem, phloem, and sclerenchyma, as well as causing disintegration of parenchyma tissue.

Microfilm $2.00; Xerox $4.60. 86 pages.

CERTAIN EFFECTS ON MITOSIS IN THE ROOT TIP OF ALLIUM CEPA FOLLOWING APPLICATION OF KINETIN AND GIBBERELLIC ACID ALONE AND IN COMBINATION WITH INDOLEACETIC ACID AND MALEIC HYDRAZIDE

(L. C. Card No. Mic 59-911)

Sister Mary Annunciata McManus, R.S.M., Ph.D.
St. Louis University, 1958

The identity of the endogenous hormones responsible for normal root elongation is uncertain. Known auxins usually inhibit root elongation, but interpretation of their action is controversial. It has become increasingly clear that further study of their effects at the cellular level is needed. Effects of gibberellin and kinetin on cells of the root have not been studied.

The effects of indoleacetic acid, the only positively identified endogenous hormone of plants, of kinetin, of gibberellic acid, and of maleic hydrazide, an auxin antagonist, were tested on growing roots of onion. Counts of mitotic

figures present after treatment with solutions of various concentrations, in various combinations and for various times indicated that mitosis was usually inhibited by treatment. The evidence obtained does not support the view that the contribution of cell division to root elongation is regulated by hormones of the indoleacetic acid, gibberellic acid, or kinetin types.

Evidence was also obtained that the most embryonic cells of the root apex, the apical initials, are relatively immune to the deleterious effects of high concentrations of indoleacetic acid and highly susceptible to those of kinetin.

Kinetin, which was discovered as a cell division factor, did not act as such in these experiments.

Maleic hydrazide was found to produce mitotic aberrations including chromosome fragmentation, anaphase lagging and bridges, and changes which gave the chromosomes a beaded appearance.

The pattern of activity as reflected in the mitotic counts was very similar for indoleacetic acid and gibberellic acid, which lends support to the view that gibberellic acid is an auxin.

The c-tumors produced by some of the treatments were caused by the radial enlargement of cortical cells just proximal to the root apex. The anticlinal walls of these cortical cells appear to be weakened. It is suggested that there may be a difference in structure and/or composition between periclinal and anticlinal walls of cortical cells, and that the type of structure which makes up the periclinal walls of stem cells may be the same or similar to the type which makes up the anticlinal walls of root cells.

Microfilm $2.00; Xerox $5.60. 114 pages.

A STUDY OF THE POLYPHENOLS AND POLYPHENOL OXIDASE PRESENT IN TOBACCO LEAVES

(L. C. Card No. Mic 59-344)

Peter Thomas Penn, Ph.D.
North Carolina State College, 1958

Supervisor: Joseph Arthur Weybrew

The identity and patterns of the major polyphenols present in tobacco leaves during development in the field and in the greenhouse, during flue-curing and as a result of different cultural and curing practices has been established. The predominant polyphenols present in fresh leaves are the chlorogenic acids, scopoletin, rutin and scopolin. Leaves from tobacco plants grown in the greenhouse contained no rutin and, in general, much less polyphenolic material.

The polyphenolic constituents were found to increase with maturity.

During flue-curing qualitative and quantitative changes occur; rutin decreased progressively, while there were substantial increases in scopoletin and substances having low Rf values and fluorescing yellow in ultraviolet light. Chlorogenic acid appeared to undergo little or no change and caffeic acid became apparent during the later stages of the cure.

With respect to the patterns of polyphenols obtained as a result of different cultural and curing practices only minor contrasts were noted between the flue-cured and burley varieties when they were both cultured and cured alike. Either type when cultured like burley, contained markedly less chlorogenic acid, rutin and caffeic acid than when grown like flue-cured. Similarly air-cured leaves of either type were lower in polyphenols than their flue-cured counterparts.

The polyphenol oxidase of tobacco leaves could be purified by ammonium sulfate fractionation and absorption and elution from calcium phosphate gel. The enzyme readily oxidized chlorogenic acid, caffeic acid and catechol but the ratios of the relative rates of oxidation of these polyphenols were influenced by the extent to which the enzyme was purified.

The K_M value of the purified enzyme for chlorogenic acid was 0.92×10^{-4} M.

The tobacco oxidase is a copper protein readily inhibited by the heavy metal poisons. The metallic prosthetic group can be removed by dialysis against cyanide resulting in a complete loss of activity; the enzyme can be reactivated by the addition of excess copper sulfate to the protein solution.

During flue-curing approximately 70% of the original polyphenol oxidase activity appears to be lost during the color-fixing period when the leaf temperatures are between 45° and 57°C. The majority of the residual activity is lost when leaf temperatures of approximately 77°C are attained during the killing out period of the cure.

Analysis of cured cherry red tobacco leaves graded for redness indicated that their chlorogenic acid and nicotine contents diminished as redness became more pronounced while nornicotine increased. It is thought that the red pigment associated with such leaves is formed at least in part as a result of the formation of a chlorogenic acid-quinone-nornicotine complex. A system converting nicotine to nornicotine is apparently necessary for the production of the cherry red coloration.

In vitro, it was shown that red pigments were elaborated when various phenolic substances were oxidized to their corresponding quinones in the presence of nornicotine. By the use of inhibitors selective for polyphenol oxidase, the peroxidase present in tobacco leaves was demonstrated to be more effective as a mediator of red pigment formation in short term model experiments.

A preliminary examination of the naturally occurring pigment showed it to be water soluble and apparently associated with a protein fraction. It also appeared to possess properties characteristic of the caffetannins.

Microfilm $2.00; Xerox $5.20. 105 pages.

ELECTRON TRANSPORT MECHANISMS IN TOBACCO ROOTS

(L. C. Card No. Mic 59-352)

Edward Carroll Sisler, Ph.D.
North Carolina State College, 1958

Supervisor: Harold J. Evans

A study has been conducted to elucidate pathways of electron transport through the respiratory chain in tobacco roots. Evidence was presented that particulate material from tobacco roots exhibit absorption bands corresponding to published values for cytochromes a and a_3. Particulate material also exhibited a broad band extending from 548 to 567 mu which includes the absorption region for the alpha bands of cytochromes b and c. It was further demonstrated that particles from roots possess the capacity to catalyze the oxidation of reduced cytochrome c and to reduce oxidized cytochrome c in the presence of DPNH or succinate. Succinic-cytochrome c reductase activity is inhibited by antimycin A and SN 5949 [2-hydroxy-3-(2-methyloctyl)-1,4-naphthoquinone]. Inhibition by these compounds presumably establishes the presence of the Slater factor in the electron transport pathway.

The particles will not catalyze the oxidation of DPNH at a substantial rate unless cytochrome c or some factor such as menadione or chlorogenic acid is included in the reaction mixtures.

The amount of cytochrome oxidase and cytochrome reductase in particulate preparations is sufficient to account for the oxygen uptake of intact tobacco roots. When the roots are homogenized with 2% digitonin the cytochrome oxidase activity of the resulting preparation far exceeds the amount required to account for oxygen uptake. Similarly, when menadione is included in the assay mixture the cytochrome c reductase capacity far exceeds the amount required to account for the respiratory rates.

The observation of the occurrence of the cytochrome components and the demonstration of the various reactions catalyzed by tobacco root extracts would suggest that the cytochrome system is an important pathway of respiration in the tobacco root.

A soluble disphorase from tobacco roots has been purified and found to be relatively nonspecific for electron acceptor. Several quinones and 2,6-dichlorophenolindophenol were about equally effective as electron acceptors. Both DPNH and TPNH would serve as substrates for the enzyme and the K_m value for both coenzymes was 8.2×10^{-5} M. When menadione was included in the reaction mixture, the enzyme would serve as a cytochrome c reductase. It has been postulated that this enzyme may transfer electrons into the respiratory chain with some quinone serving as an intermediate.

Chlorogenic acid will reduce cytochrome c in the absence of an enzyme, and the oxidized chlorogenic acid is reduced nonenzymatically by DPNH. The rate of reduction did not appear to be sufficiently high to account for all of the electrons transferred in respiration.

The tobacco root polyphenol oxidase was purified, and it was shown that an alternate pathway of electron transport could occur in vitro which did not involve the cytochrome system. Polyphenol oxidase will catalyze the oxidation of chlorogenic acid and the oxidized form of this compound is reduced by DPNH. The importance of this pathway in vivo has not been determined.

The K_m values obtained for cytochrome oxidase with respect to oxygen were 4.5×10^{-6} M for a digitonin preparation and 5×10^{-6} M for a particulate preparation. Similarly, the K_m value for the purified polyphenol oxidase for oxygen was 1.5×10^{-5} M.

Microfilm $2.00; Xerox $4.80. 94 pages.

WHAT SCIENCE PRINCIPLES ARE BASIC TO THE CONSERVATION OF SOILS, FORESTS AND GRASSLANDS? AN INVESTIGATION TO DETERMINE THE SCIENCE PRINCIPLES UNDERLYING THE PROBLEMS AND ADVOCATED PRACTICES OF THE CONSERVATION OF SOILS, FORESTS AND GRASSLANDS.

(L. C. Card No. Mic 59-1025)

Vincent Eugene Vivian, Ph.D.
New York University, 1958

Chairman: Professor J. Darrell Barnard

This study was undertaken to answer certain needs detected in conservation and science education literature. Conservation, a social and scientific problem of ever-increasing importance, was found to be a most desirable inclusion in some aspects of the curricula at elementary, secondary and collegiate levels.

Nowhere in a wide range of such literature could there be found concise and organized statements of the problems involved in the conservations of soils, forests and grasslands or the practices advocated for their solution. Moreover, no collection of science principles forming the underlying basis or explanation of such conservation problems could be found.

On the other hand, science education literature contained well-documented and substantiated statements showing the desirability of:

1. the problem approach in science teaching,
2. the expansion of conservation in science curricula and
3. the understanding of principles as goals of science instruction.

A thorough analysis of the Yearbooks of the United States Department of Agriculture was undertaken to detect:

1. problems of the conservation of soils, forests and grasslands,

2. the measures advocated for their alleviation or solution and

3. principles of science underlying such problems and measures.

Validation of the statements of problems, measures and science principles found was made by application of criteria approved by previous investigators of principles of science and by the judgments of scientists specializing in the fields to which the principles relate. The validity of the statements of science principles was further established by the action of a second jury which was employed to select the relative significance of each principle for the problems with which it was associated.

The reliability of the establishment of conservation problems and measures was checked by a second analysis of a selected portion of the Yearbooks. The reliability of the judgments of the second jury was determined by having representative members make a repeat judgment on the significance of some of the same principles. Both reliability checks showed a high correspondence with the original work.

A collection of validated, classified problems of the conservation of soils, forests and grasslands was obtained together with the measures advocated for their solution or alleviation. Simultaneously, a list of validated science principles associated with the problems and measures was produced. In addition, a list of the principles in order of their significance for their related problems and measures was compiled.

A study of the 158 problems found in this investigation indicated that soil conservation is basic natural resource use. The majority of soils problems was concerned with fertility, soil structure and development and erosion. Forest growth and the relation of the forest to environmental factors led the problems of forest conservation, while forage production problems were most pressing in grasslands conservation. Analysis and interpretation of the 255 classified measures advocated for the wise use of these resources reinforced these views.

A study of the 279 science principles obtained revealed that all measures advocated for alleviation of the problems were based on at least one science principle. The principles were shown to have high significance for the problems with which they were associated.

The principal recommendations were:

1. Units of study and conservation should be constructed using the newly-stated problems, measures for conservation and science principles.

2. Science testbook authors should include more conservation problems and principles now available.

3. This study should be continued in the areas of water and wildlife conservation.

4. Results of this study should be disseminated through appropriate professional journals.

Microfilm $4.00; Xerox $13.40. 309 pages.

CHEMISTRY, GENERAL

REACTIONS OF METAPHOSPHATES IN SOILS

(L. C. Card No. Mic 59-1192)

Julian Donoso-Torres, Ph.D.
Cornell University, 1958

Dissolution and hydrolysis of metaphosphate fertilizers were studied in acidified solutions at 25°C and 0°C as well as in soils. The hydrolysis of sodium metaphosphate (1.2 Na_2O : 1 P_2O_5) in water or acidified solutions followed an apparent first order reaction. The heat of activation was found to be 23.5 kcal. Although the actual mechanism by which calcium metaphosphate dissolves and hydrolyzes in acidified solutions may involve several intermediate steps, the overall process can be treated as an apparent first order reaction. The rate of hydrolysis is the rate determining step in the degradation of $Ca(PO_3)_2$ and the heat of activation is approximately 19.4 kcal.

Sodium metaphosphate, T.V.A. ammonium metaphosphate, T.V.A. calcium metaphosphate, and potassium dihydrogen phosphate were thoroughly mixed with two soils (Mardin silt loam, pH 4.2 and Ontario silt loam, pH 6.2) at a rate of 5,000 lbs. P_2O_5 per 2,000,000 lbs. of soil. The treated soils were maintained at 25 per cent moisture content at room temperature for one hour, 6 weeks, and 15 weeks after which time they were subjected to one extraction with 0.1 N NH_4Cl, followed by two successive extractions with 0.5N NH_4F. The concentration of orthophosphate in the NH_4Cl and NH_4F extracts was determined before and after hydrolysis.

The extractions of soils at room temperature resulted in appreciable hydrolysis of the condensed phosphates (15% for $NaPO_3$ and 50% for $Ca(PO_3)_2$ even when the soils were extracted one hour following the application of the materials.

The metaphosphate was fixed to greater extent than the orthophosphate. At the end of 6 and 15 weeks, significant amounts of condensed phosphate were still present in the Mardin silt loam treated with the metaphosphate materials, whereas the amounts of condensed phosphate found in the Ontario silt loam were of the same order of magnitude as those found in the KH_2PO_4-treated soils and obviously represented soil organic phosphorus compounds released by orthophosphate and extracted by NH_4F solution.

In two soils (Mardin silt loam, pH 5.0 and Honeoye silt loam, pH 7.2), $NaPO_3$, $Ca(PO_3)_2$, and $Ca(H_2PO_4)_2 \cdot H_2O$ were placed in a vertical band by placing the fertilizer in a cylindrical well (6 mm in diameter and 3.5 cm deep). The soils were brought to 25 per cent moisture content and maintained at 25°C in a chamber saturated with water vapor. After 17, 46, and 52 days, soil samples representing rings of rectangular cross section were taken by means of a cork boring machine in order to determine the radial distribution of phosphorus in the soil. The soils were again extracted with 0.1N NH_4Cl and 0.5N NH_4F but all operations were carried out at 0°C in order to prevent hydrolysis of the metaphosphates.

The distribution of phosphorus in the soil samples at varying radial distances from the fertilizer band varied greatly with different materials and soils. Water soluble $NaPO_3$ showed the greatest mobility as measured by the distance of its penetration. Large amounts of phosphorus in $Ca(PO_3)_2$ moved laterally into the soil but was immobilized within a short distance (2 cm) from the fertilizer band.

The mechanism of dissolution and transport of the three fertilizer salts was apparently largely by absorption of water vapor and subsequent movement of the salt solution by capillary conduction. After 46 days, 50% of the total phosphate in the soil that had moved out of the $Ca(PO_3)_2$, and only 25% of the total phosphorus that had moved out of the $NaPO_3$ band was present in the condensed form.

Microfilm $2.10; Xerox $7.40. 160 pages.

A STUDY OF THE RARE EARTH ACETYLACETONATES

(L. C. Card No. Mic 58-5715)

James A. Kennelley, Jr., Ph.D.
Michigan State University, 1956

The 2,4-pentanedione derivatives of the rare earths are the only chelate compounds of these elements which may be easily prepared in the pure form. This work is a more complete and detailed characterization of these compounds than may be found in the literature up to the present time.

Through a slight variation in the normal preparative procedure large crystals of rare earth acetylacetonates could be prepared. All of these rare earth compounds which were prepared and dried in air at room temperature were shown to be hydrated. Drying studies were made and it was found that the water of hydration could be removed with ease only from small amounts of these compounds.

Rare earth acetylacetones could easily be extracted from chloroform into water. The distribution in the chloroform-water system was shown to be pH dependant. Very little difference in the distribution of individual rare earths was observed.

The absorption spectra of these compounds were observed in the ultraviolet, visible, and infrared regions. The infrared spectra are discussed and compared with the spectrum of acetylacetone.

The solubilities of neodymium, and europium acetylacetonates as a function of temperature were determined in benzene, chloroform, carbon tetrachloride, and acetylacetone. The solubility of lanthanum acetylacetonate was determined in benzene. Each of these compounds was shown to have a positive temperature coefficient of solubility.

The structure of these rare earth compounds in relation

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to physical properties is discussed. X-ray powder patterns of these compounds were also determined.

A qualitative survey of the solubility of neodymium acetate in various organic solvents is included. No solvent was found in which this compound is appreciably soluble.

Microfilm $2.00; Xerox $5.20. 102 pages.

CHEMISTRY, ANALYTICAL

INFRARED ANALYSIS OF INORGANIC ANIONS

(L. C. Card No. Mic 59-456)

Fred Fa-wu Cheng, Ph.D.
Emory University, 1958

Supervisor: A. L. Underwood

By combining freeze-drying and the potassium bromide disk technique, aqueous salt solutions can be easily prepared for infrared examination. Based on this fact, infrared methods are developed for quantitative analysis of inorganic anions.

Part I consists of the development of an infrared method for direct determination of phosphate. In the course of this study, three groups of experiments have been undertaken.

(1) Study of the effect of pH on the shape of the spectra reveals that a phosphate solution at pH 11.0 $\pm$ 0.2 is optimal for producing well-defined bands for analysis. These bands are at 6.0 μ, 11.75 μ and 12.05 μ.

(2) Potassium tribasic phosphate is used as a standard compound, forming solutions with pH values of about 11.0. Three working curves are constructed from measurements at the three regions mentioned above.

(3) Using phosphoric acid and two potassium acid phosphates as samples, the phosphate contents have been determined from the working curves. Maximum error involves a difference of 0.013 mg. (measured at 11.75 μ) or a difference of 0.019 mg. (measured at 6.0 μ) from a sample containing around 0.3 mg. of phosphate-ion.

Part II consists of analysis of mixtures of anions. For further application of the method developed in Part I, binary mixtures are tested. Four types of mixtures are employed.

(1) Phosphate and thiocyanate mixture represents a solution consisting of anions which do not interact in the infrared absorption. Measurements can be made for both anions with no interference from each other.

(2) Nitrate and sulfate mixture represents another example of non-interaction in absorption. They clearly show their individual bands in the mixture. But determination of them requires construction of a working curve for nitrate from the binary mixture.

(3) Phosphate and nitrate mixture represents a case where the absorption bands of the components occur at the same location. An elimination procedure is proposed. At pH value 5.5 the phosphate band is "eliminated," and the nitrate band still remains. Therefore, the components are determined in two spectra, one from the solution mixture at pH value 11.2 to determine phosphate, preferably measured at 11.75 μ, and the other from the solution of pH value 5.5 to determine nitrate.

(4) Phosphate and sulfate mixture presents the same trouble as in the case of phosphate and nitrate mixture, but the phosphate absorption at the common spectral position is so strong that a simple infrared method is not applicable.

Part III consists of the development of an infrared method for the indirect determination of phosphate. In the development of an infrared method for direct determination of phosphate, two drawbacks have been noticed. First, the bands used for measurements are not truly characteristic bands for phosphate alone. Second, the pH adjustment to a high value of about 11.0 as required in that method is a handicap in the manipulation. An infrared indirect method has been developed. It is considered to be much simpler and more reliable than the direct method. This method consists of conversion of phosphate into pyrophosphate under standard conditions from which the determination by infrared method is made. Four groups of experiments have been performed.

(1) The Lambert-Beer Law check of pyrophosphate powder is first performed. The calibration curve for pyrophosphate shows a straight line from the origin.

(2) Subsequent check of this law is made with the pyrophosphate converted from sodium and potassium monohydrogen phosphate. The data also conform very satisfactorily to the Lambert-Beer Law.

(3) Potassium monohydrogen phosphate is used as standard solution. By employing the combined freeze drying and potassium bromide disk technique together with the conversion of this phosphate to pyrophosphate, a working curve for pyrophosphate, or indirectly for phosphate, has been constructed.

(4) To illustrate the usefulness of this indirect method, some other phosphate solutions are tested. Phosphoric acid, sodium and potassium dihydrogen phosphates, and potassium tribasic phosphate have been used as samples for analysis. Very satisfactory results have been obtained.

A procedure for analysis of phosphate by an infrared method is finally proposed.

Microfilm $2.00; Xerox $6.40. 132 pages.

POLAROGRAPHIC REDUCTION OF AROMATIC NITRO AND CARBONYL COMPOUNDS

(L. C. Card No. Mic 59-457)

Julia Thomas Gary, Ph.D.
Emory University, 1958

Supervisor: R. A. Day, Jr.

Organic compounds containing several reducible groups give polarographic reduction patterns of such complexity that the nature of the process is not immediately apparent. Three nitro-substituted fluorenones were chosen for study, namely, 2-nitrofluorenone, 2,7-dinitrofluorenone, and 2,5-dinitrofluorenone. Polarograms were obtained on buffered solutions of the compounds over a pH range of 1 to 13. From these were obtained the pH dependence of half wave potentials and the effect of acidity and basicity on the reduction. Coulometric analysis at carefully controlled cathode potentials gave values of n, the number of electrons involved in each stage of the reduction. Polarographic and coulometric studies were made on a series of compounds structurally related to the nitrofluorenones but

containing only a single type of reducible group. Carbonyl behavior was studied in benzophenone, fluorenone, and 2-aminofluorenone. Three nitrobiphenyls, namely, 4-nitrobiphenyl, 4,4'-dinitrobiphenyl, and 2,2'-dinitrobiphenyl and 2,5-dinitrofluorene were used to study the reduction of the nitro group. The present study is an attempt to elucidate the reduction behavior of the nitrofluorenones from these data.

Reduction of the nitro group to the hydroxylamine takes place at a lower potential than is required for other types of reduction under consideration. In the case of compounds containing two nitro groups, this first nitro wave is generally found to split in near neutral media. The pH at which the splitting occurs and the potentials of the two resulting waves were found to depend upon the position of the nitro groups relative to one another. In general, the conversion of the carbonyl group to a secondary alcohol is responsible for the next type of reduction. With compounds containing the carbonyl as the only functional group, the reduction often takes place in two well-defined steps in acid media. Where the hydroxylamine group is present, as in the nitrofluorenones, the two carbonyl waves are merged. Complete reduction of one nitro group to the amine is usually observed in acid media at more negative potentials. In the case of dinitro compounds, complete reduction of the second nitro group is not observed. Because of the alkaline reactions of the nitro group, no attempt was made to study the reduction pattern beyond pH 9, though half wave potentials are reported.

Microfilm $2.00; Xerox $3.60. 62 pages.

INFRARED SPECTROPHOTOMETRY OF INORGANIC ANIONS

(L. C. Card No. Mic 59-462)

Han Tai, Ph.D.
Emory University, 1958

Supervisor: A. L. Underwood

Infrared spectrophotometry for inorganic nitrate and nitrite was studied by applying the potassium bromide disk technique. The freeze-drying method was used for homogeneously dispersing the sample in 200 or 300 mg. of potassium bromide with very fine and uniform particle size.

Absorption at 7.23 μ was chosen as the characteristic band for nitrate and 7.87 μ for nitrite. The optimal analytical range for potassium nitrate is 6γ to 30γ with a standard deviation of about 3%; for potassium nitrite 40γ to 140γ with standard deviation of 2%. A statistical study applying the t-test showed that bias existed between different runs for nitrate, but not for nitrite.

It was possible to determine nitrate and nitrite in a mixture of both ions. The contribution of the weak absorption of nitrite at 7.23 micron could be calculated from its ratio of absorbance to the 7.87 micron band.

Oxidation of potassium nitrite, and separation and concentration of inorganic anions on an anion exchanger, Dowex-1, were studied to test the applicability of the infrared method. Microfilm $2.00; Xerox $5.60. 112 pages.

CHEMISTRY, BIOLOGICAL

AN INVESTIGATION OF THE ROLE OF GROWTH HORMONE IN THE PROCESS OF CARDIAC GLYCOGEN ACCUMULATION INDUCED BY FASTING IN THE NORMAL RAT

(L. C. Card No. Mic 58-5109)

George Adour Adrouny, Ph.D.
Emory University, 1954

Studies of the glycostatic effect of growth hormone have recently led to the postulation of the hypothesis that growth hormone may be an important factor in the increase of cardiac glycogen which occurs in fasting animals. Further elucidation of this relationship constitutes the first end of the present investigations. The second object has been the establishment of conditions for a bioassay of growth hormone based on the increase of cardiac glycogen in normal rats.

The investigations directed towards an understanding of the role of growth hormone in the cardiac glycogen increase of fasting included the following experiments. The time course of cardiac glycogen accumulation on fasting was established by determination of values in various groups of adult male Sprague-Dawley rats, fasted for intervals ranging from 0 to 168 hours. In these and all succeeding experiments, determinations of glycogen were carried out separately on the two fractions of total glycogen: trichloroacetic acid-extractable (TCA-extractable) and residual. Adoption of this procedure was prompted by the consideration that TCA-extractable glycogen, being the physiologically labile form of total glycogen, would reflect more directly and faithfully, the changes undergone by cardiac glycogen under various circumstances. On fasting, the intact rat showed a progressive rise in cardiac glycogen from the unfasted level of 400-450 mgm. per cent to a plateau of about 770 mgm. per cent attained within 48 hours, and maintained during an additional period of five days. Feeding of carbohydrate, protein or fat of equivalent calorific value to animals that were fasted 48 hours indicated the effect of various nutrients in the inhibition or enhancement of cardiac glycogen accumulation: carbohydrate and protein induced an abrupt fall, while fat effected no appreciable change.

Exogenous growth hormone administered in various doses and modes to intact rats accelerated the attainment of levels of cardiac glycogen which were even higher than those induced by fasting alone. Maximum effects were seen in a 12-hour interval: total cardiac glycogen levels in untreated fasting animals, in fasting animals given a single dose of 500 micrograms of growth hormone, and in those "maintained" on the same dose by repeated injections at 6-hourly intervals were 575, 815 and 1084 mgm. per cent respectively. In the case of fed animals, the hormone exerted a significant but less marked effect: a total cardiac glycogen level of 661 mgm. per cent was attained as a result of treatment with a 12-hour "maintained" dose of 500 micrograms of hormone.

Dose-response relationships for the establishment of an assay method were determined under three different modes of administration of growth hormone: 6-hour single dose; 12-hour single dose; 12-hour divided dose. Of these, the 6-hour single dose method was adopted for the establishment of additional data. A linear relationship

between the logarithms of the doses of growth hormone administered ($31\frac{1}{4}$ to 1000 micrograms) and total cardiac glycogen or its TCA-extractable fraction was demonstrated.

The role of the corticotrophic and cortical hormones in modifying the glycostatic effect of growth hormone also was studied. The intact animal showed a rise in cardiac glycogen under the influence of various brands of adrenocorticotrophic hormone (ACTH). Adrenalectomy appeared to render the animal insensitive to the glycostatic effects of growth hormone within a 6-hour period; this observation did not parallel the findings by other investigators that the glycogen increase of fasting was unimpaired in adrenalectomized animals during a 24-hour period.

The interpretations of the various observations and the conclusions drawn therefrom may be summarized as follows. Increased growth hormone secretion, increased activation of growth hormone, or a combination of the two processes are considered as possible mechanisms in the increase of cardiac glycogen. Carbohydrate, fed directly or that derived from fed protein by gluconeogenesis, appears to repress the secretion or activation of growth hormone; fat does not exhibit a similar effect. The fact that exogenous growth hormone accelerated or exaggerated the effects of fasting on cardiac glycogen is considered as a direct confirmation of the controlling role of growth hormone in cardiac glycogen accumulation. Since the glycostatic activity of the hormone was less marked in fed animals, it is concluded that the repressive effect of feeding appears to be exerted in part on the activity of growth hormone, but possible effects on the secretion of growth hormone might also occur.

With regard to the application of the glycostatic effect in the assay of growth hormone, it may be said that the test based on cardiac glycogen appears to be fairly sensitive qualitatively, but the relatively large indices of precision show it to be unsuitable for exact quantitative assay. The higher index of precision obtained in the case of TCA-extractable glycogen did not support the earlier expectation that this fraction might yield more accurate results in a bioassay.

The apparent glycostatic effect of ACTH in the intact animal is attributed either to contamination of the ACTH samples with growth hormone, or to a potentiation of the endogenous growth hormone under the influence of the corticotrophic hormone, or to a combination of the two processes. While the present investigations allow no definite explanation for the differences in results obtained with adrenalectomized animals, it has been suggested that the simultaneous operation of two effects, proceeding at different rates, might account for the contrast between the 6-hour and 24-hour periods of adrenalectomy. These effects would be: a) a rapid potentiation of growth hormone under the influence of cortical hormone; b) the slow and direct glycostatic effect of growth hormone, exerted independently of the cortical hormone.

The data obtained in all the experiments showed invariably that the changes undergone by total glycogen are reflected to a much greater extent by the TCA-extractable fraction; the residual fraction seldom surpassed an average level of about 250 mgm. per cent. These observations confirmed the findings by other investigators that TCA-extractable glycogen constitutes the labile and physiologically significant fraction of total cardiac glycogen.

Microfilm $2.00; Xerox $7.00. 146 pages.

HEXOSE PHOSPHATES IN THE SMALL INTESTINE OF THE RAT DURING GALACTOSE ASSIMILATION

(L. C. Card No. Mic 59-1386)

Donald Frank Diedrich, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Laurens Anderson

The chromatographic fractionation technique of Goodman et al. (elution from Dowex 1 with borate ion, J. Am. Chem. Soc. 77: 4257, 1955) was extended to the separation of galactose 1-phosphate (Gal-1-P) from a mixture of other commonly occurring hexose phosphates including glucose 1-phosphate (G-1-P). Mannose 6-phosphate was eluted with fructose 6-phosphate, and galactose 6-phosphate with glucose 6-phosphate; a number of elution systems which were tried with a view to resolving these pairs of esters were ineffective.

The chromatographic technique was used to search for galactose phosphates in extracts of the small intestines of rats which had been administered an oral dose of galactose. However, the amounts of hexose phosphates which could be isolated were too small, and their purity was insufficient, to permit their identification and measurement by paper chromatography and colorimetric analyses.

A specific enzymatic assay was devised for Gal-1-P and G-1-P in mixtures. This procedure involved the measurement of the reduced triphosphopyridine nucleotide (TPNH) formed when phosphoglucomutase and glucose 6-phosphate dehydrogenase were added to the mixture. After the initial increase in absorbancy at 3400 Å resulting from the conversion and dehydrogenation of G-1-P was recorded, the Gal-1-P was determined by adding uridine diphosphate glucose and Gal-1-P uridyl transferase to the reaction mixture and measuring the second increase in absorbancy. It was found, however, that a crude trichloroacetic acid extract of intestine could not be assayed with this technique because of the presence of some undetermined substance which served as substrate for a contaminating enzyme present in the glucose 6-phosphate dehydrogenase and which effected the immediate reoxidation of the TPNH. This unknown substance could not be separated from the hexose phosphates by straightforward fractionation on Dowex 1 with formate as the eluant. However, the use of the borate chromatographic system finally permitted the isolation of G-1-P and Gal-1-P in a state sufficiently pure to be assayed enzymatically.

Measuremen' were made of these two hexose phosphates in intestinal extracts from rats which were given L-sorbose (control) and D-galactose (experimental) by gavage. The levels of G-1-P in the experimental groups (1×10^{-2} μmoles per gm. fresh intestine) did not differ from those found in the control animals. No Gal-1-P could be detected in the sorbose intubated animals but very large amounts of the galactose ester were found in the galactose intubated group (14×10^{-2} μmoles per gm. fresh intestine).

Maintaining the weanling rats on stock diets supplemented with 8 percent glucose, 8 percent galactose, or 16 percent lactose for one month before the experimental procedure did not seem to have a significant effect on the levels of the hexose 1-phosphates present in the intestines.

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These data show conclusively that Gal-1-P is present in rat intestine during the absorption of galactose, and suggest that intestinal tissue contains galactokinase, which catalyzes the direct phosphorylation of the sugar. The results are discussed with reference to the phosphorylation theory of active sugar absorption. Microfilm $2.00; Xerox $5.80. 119 pages.

STUDIES ON LIPID PORTIONS OF RUMEX CRISPUS, L.

(L. C. Card No. Mic 59-1166)

Irving Isaac Domsky, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Aaron Ihde

The literature reveals no evidence that the seed lipids of the buckwheat family (Polygonaceae) have been investigated. In the present study, a wax was extracted from the valves and an oil from the achene-"grain" mixture of the fruiting enflorescences of Rumex crispus, L., a weed which constitutes one of the more abundant members of the Polygonaceae family in North America.

The oil was obtained by benzene extraction, constituting 1.77 percent of the achene-"grain" mixture. The major acids are palmitic acid (20%), stearic acid (19%), oleic acid (42.6%), and linoleic acid (18.3%). The major sterol is β-sitosterol. Other sterols are present, but could not be isolated in large enough amounts to be identified. Evidence indicates that the major aliphatic alcohol is n-docosanol, although it was not isolated as a pure compound. The major hydrocarbons in the oil appear to be n-octacosane and n-triacontane, but these too were not isolated as pure compounds and neighboring homologues may be present.

Benzene extraction of the valves gave 1.06 percent of a hard, black wax. The major acids are palmitic acid (12%), stearic acid (43%), oleic acid (37.5%), and linoleic acid (6.7%). Although the major sterol in the wax is β-sitosterol, it is contaminated with other sterols which were not isolated as pure compounds. The hydrocarbon mixture is quite complex, and may contain a hydrocarbon with a melting point as low as 40°C. The alcohol portion is predominantly a mixture of 26 carbon and 28 carbon aliphatic alcohols.

Microfilm $2.00; Xerox $3.00. 51 pages.

INVESTIGATION OF COLOR REACTIONS FOR THE DETERMINATION OF CARBOHYDRATES WITH PARTICULAR EMPHASIS ON ANTHRONE

(L. C. Card No. Mic 58-5139)

William Fay Durham, Ph.D.
Emory University, 1950

The purpose of the investigation reported in this dissertation was to study the specificity and the mechanism of action of various chromogenic reagents used in the quantitative determination of carbohydrates. Since anthrone gives promise of becoming the most useful of these reagents, a major part of the study is devoted to it.

Details are given of a suitable procedure for the synthesis of anthrone and of the technique employed in the quantitative determination of carbohydrates by the anthrone reagent. In the investigation of the mechanisms involved in the anthrone reaction, a new and relatively simple method for the synthesis of 5-hydroxymethylfurfural was developed. This involves treatment of sucrose with HCl and hydrolysis of the chloromethylfurfural formed with barium carbonate.

In the case of disaccharides and polysaccharides, it appears that the first step in the reaction with the anthrone reagent is hydrolysis to the constituent monosaccharides. By a series of spectrophotometric comparisons, evidence was obtained that furfural or one of its derivatives functions as an intermediate in the condensation with anthrone. Identical absorption curves were obtained for the anthrone complex from arabinose and from furfural; for that from glucose and 5-hydroxymethylfurfural; and from rhamnose (a methylpentose) and 5-methylfurfural. These facts indicate that the functional intermediate which condenses with anthrone to yield the complex in the case of the pentoses is probably furfural; in the case of the hexoses, 5-hydroxymethylfurfural; and in the case of a methylpentose, methylfurfural.

The green-colored complex formed by reaction between furfural or a pentose and the anthrone reagent was unstable. It was found that this colored compound could be stabilized by cooling in an ice bath. The ascorbic acid-anthrone and cinnamaldehyde-anthrone complexes were also unstable, and could likewise be stabilized by cooling. However, the absorption curves of the latter two complexes show that these are not identical with analogous carbohydrate products.

A red-brown color was noted upon the addition of anthrone reagent to furfuryl alcohol and to desoxyribonucleic acid. A spectrophotometric comparison of the furfuryl alcohol-anthrone product and of the desoxyribonucleic acid-anthrone product showed them to be identical. Both furfuryl alcohol and desoxyribose are converted by acids to ω-hydroxylevulinic aldehyde without passing through the furfural stage. This indicates that the reactive intermediate in the formation of the red-brown complex by these compounds and anthrone is ω-hydroxylevulinic aldehyde.

Attempts were made to isolate the dyestuff responsible for the green color formed between carbohydrates and the anthrone reagent. Although three different methods of isolation were attempted, the dye was not isolated. The reason for this was attributed to the fact that in the experiments tried, furfural was used as the starting material. Due to its peculiar instability, the furfural-anthrone compound decomposed before it could be isolated.

A study was made of various condensing agents in an attempt to find one less hazardous to work with than concentrated H_2SO_4. Of the compounds investigated only phosphorus oxychloride was found to be capable of catalyzing the reaction in an aqueous medium. Anhydrous zinc chloride was able to effect the condensation in organic solvents.

Absorption curves of the carbazole reaction complexes were similar with all of the following: furfural, arabinose, 5-hydroxymethylfurfural, glucose, galactose, mannose, fructuse, desoxyribonucleic acid, and furfuryl alcohol. Since the common intermediate of acid degradation of all these compounds is ω-hydroxylevulinic aldehyde, it appears

that this aldehyde may be the reactive intermediate in the carbazole reaction.

Similar absorption curves were found for the orcinol condensation products obtained from furfural, arabinose, 5-hydroxymethylfurfural, glucose, fructose, desoxyribonucleic acid and furfuryl alcohol. These findings likewise implicate ω-hydroxylevulinic aldehyde as the functional intermediate in the orcinol reaction.

A comparative study was carried out on a large series of carbohydrates and non-carbohydrates using anthrone, carbazole, orcinol, diphenylamine, and α-naphthol under as nearly similar conditions as possible. Anthrone and α-naphthol give similar results. With these reagents positive reactions were given only by cortisone and cinnamaldehyde among the non-carbohydrates. Carbazole was found to be more sensitive, but less specific for carbohydrate than was anthrone. The specificity of orcinol was found to be similar to that of carbazole, but the former is less suitable for quantitative determinations since none of its condensation products was found to exhibit a sharp absorption peak. Diphenylamine gave no color with any of the materials tested under the experimental conditions employed.

The anthrone reaction was found to be satisfactory for use in the quantitative determination of dextran and of inulin. Considerable saving of time with no loss in accuracy is the advantage offered by this method over those employing hydrolysis followed by copper reduction.

The carbazole reagent was proved to be suitable for quantitative carbohydrate determinations when used in the same strength sulfuric acid solution as anthrone. Since the carbazole reagent is about three times as sensitive as the anthrone, it may be applied to the determination of carbohydrate material in smaller concentration.

Trichloroacetic and tungstic acids are both shown to be suitable for the deproteination of blood in the determination of blood sugar levels with the anthrone reagent, provided that the deproteinizing procedure is correctly followed, particularly with respect to concentration and amount of deproteinizing agent employed.

Procedures employing the anthrone reagent are suggested for the determination of ribonucleic acid and desoxyribonucleic acid in the presence of each other; and also for the determination of hexoses and pentoses in the presence of each other. Microfilm $2.00; Xerox $4.80. 95 pages.

METABOLIC FUNCTIONS OF BIOTIN

(L. C. Card No. Mic 59-1389)

Mario Garcia-Hernandez, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Henry A. Lardy

Earlier investigations on the role of biotin in biological systems have shown that this vitamin functions in enzyme catalyzed reactions involving carboxylation, decarboxylation and deamination. A function for biotin in fatty acid systhesis has become more clear. The work recently published shows that the synthesis of amylase and albumin in the chick is in some manner related to biotin deficiency. Some authors have postulated a role for biotin in the process of incorporation of methionine into the proteins of rat tissues. Other workers have indicated a possible function of biotin in oxidative phosphorylation and in nitrogen fixation. Studies oriented toward the elucidation of the mode of action of biotin are presented in this thesis. They have been carried out under the approach that the vitamin functions in protein-enzyme biosynthesis.

1. The study of two transcarbamylation reactions catalyzed by liver preparations of normal and biotin deficient rats has revealed that the activities of the ornithine and aspartic acid carbamylases are decreased about 50 and 40 per cent, respectively, as a result of the vitamin deficiency. Complete restoration of the carbamyl phosphate-ornithine transcarbamylase activity to normal levels was obtained by administration of biotin to the deficient animals. Attempts to demonstrate an in vitro effect by biotin or by extracts prepared from normal liver tissue were unsuccessful. The results suggest an indirect role of biotin in enzymatic reactions involving the transfer of a carbamyl group.

2. The tryptophan peroxidase-oxidase (TPO) system of rat liver was used to investigate the role of biotin in enzyme synthesis. Liver homogenates of rats suffering of severe biotin deficiency showed a significant enhancement in TPO enzymatic activity over the normal preparations. The injection of biotin restored to normal the high activities observed. The induced rise of the TPO by L-tryptophan or cortisone was not disturbed in biotin deficient animals.

3. The study of amino acid activation by liver preparations from normal and biotin deficient rats has provided some information. When a mixture of seven amino acids was used as the substrate, liver "pH 5 enzymes" of biotin deficient rats yielded equal amounts of hydroxamate than normal preparations. An in vitro stimulation by biotin was observed. Liver preparations from normal and deficient animals catalyzed at the same rate the activation of methionine. Among the 17 amino acids tested, isoleucine was not activated by biotin deficient preparations. A lowering in alanine hydroxamate formation and an enhancement in proline activation was observed as a result of the vitamin deficiency. No differences were found with the rest of amino acids.

Addendum I. Identification and Quantitative Determination of Keto Acids by Paper Chromatography

During the studies on the oxidation of tartaric acid by an enzyme system of mitochondria, a method for the systematic analysis of keto acids and other carbonyl compounds in biological material was developed. It is based on the following procedures: (1) Their conversion to dinitrophenylhydrazine (DNPH) derivatives under mild conditions, (2) preliminary chromatographic separation into acidic and non-acidic DNPH derivatives, (3) isolation of each component by paper chromatography and (4) identification by means of co-rechromatography and catalytic reduction to the amino derivatives.

Addendum II. Inhibition of Enzymic Transamination of Aspartic Acid

An extract of acetone powder of pig kidney mitochondria, rich in aspactic-α-ketoglutaric acid transaminase, also catalyzes the transamination of hydroxyaspartate.

Hydroxyaspartic acid was found to be a competitive inhibitor of the transamination of aspartate and α-keto-glutarate. Diaminopropionic and diaminosuccinic acids also inhibit transamination of aspartate. The inhibition by diaminopropionic acid is non-competitive, whereas that by diaminosuccinic acid is a combination of competitive and non-competitive type. Hydroxyaspartate and diaminosuccinate in equimolar concentrations with aspartate inhibit transamination by 50 per cent, while diaminopropionate is slightly less effective.

Microfilm $2.00; Xerox $4.20. 77 pages.

A STUDY OF TRYPTOPHAN METABOLISM IN THE RAT USING THE ISOTOPIC TRACER TECHNIQUE

(L. C. Card No. Mic 59-512)

Robert Karl Gholson, Ph.D.
University of Illinois, 1958

The metabolism of the tryptophan side chain in the rat was studied using tryptophan-α-C^{14}. This compound was administered by intraperitoneal injection and by stomach tube, and the distribution of C^{14} in tissue components and excretion products determined. More than one-third of a 51 mg dose was exhaled as $C^{14}O_2$ when the isotope was injected, and less than one-sixth when it was given by stomach tube. A higher percentage of C^{14} was also found in all other fractions except urine and the contents of the digestive tract when the isotope was injected. These differences were attributed to a more rapid absorption of the injected tryptophan. The patterns of C^{14}-labeling found in the amino acids isolated from the carcass and liver proteins of the two animals were almost identical and indicated that in the major pathway of tryptophan catabolism, the side chain is removed as pyruvate or its metabolic equivalent. This finding strongly supports the kynurenine-3-hydroxyanthranilic acid pathway as the quantitatively most important route of tryptophan metabolism.

In serine, C^{14} is randomized in carbons 2 and 3 while only C-1 of acetate contained C^{14}. This was interpreted to mean that serine is formed from pyruvate arising from tryptophan via the dicarboxylic acid shuttle while acetate is produced directly from pyruvate.

The major radioactive compound found in the urine was D-tryptophan which accounted for about 40 per cent of urinary C^{14}. Other important components were urea, and indoleaceturic acid.

The metabolism of the benzene ring of tryptophan was studied using tryptophan-7a-C^{14} and 3-hydroxyanthranilic acid-1-C^{14}. When 51 mg of tryptophan-7a-C^{14} was administered by intraperitoneal injection, about one-third of the C^{14} appeared in the $C^{14}O_2$ after 12 hours, indicating a rapid and complete degradation of the benzene ring. The labeling patterns found in the amino acids from carcass and liver proteins were consistent with the conversion of tryptophan-7a-C^{14} to acetate-1-C^{14}. The only inconsistency was in the ratio of C^{14} found in carbon-5 and carbon-1 of glutamate. The distribution of the C^{14} in the lipids supported the intermediate formation of acetate-1-C^{14} and acetate-trapping experiments confirmed this conversion. Acetate produced from tryptophan-3a, 7a, 7-C^{14} was labeled in such a way as to show that acetate was formed from carbon-7a and an adjacent ring carbon.

When 3-hydroxyanthranilic acid-1-C^{14} was injected intraperitoneally into rats, about 30 per cent appeared as $C^{14}O_2$ within 12 hours. Acetate, with 90 per cent of its C^{14} in the methyl group, was formed from this compound when it was given to rats by injection or stomach tube. The possibility that the carboxyl of 3-hydroxyanthranilic acid could form carbon-1 of this acetate was eliminated by acetate-trapping with 3-hydroxyanthranilic acid-1, carboxyl-C^{14}. The findings enumerated above were interpreted to mean that the benzene ring of tryptophan is converted to CO_2 via 3-hydroxyanthranilic acid and acetate, with carbon-7a and carbon-3a of tryptophan giving rise to the carboxyl and methyl groups of acetate respectively.

Pyridoxine deficiency was found to sharply reduce the conversion of tryptophan-7a-C^{14} to $C^{14}O_2$, and to greatly increase the per cent of C^{14} appearing in the urine. A single thiamin deficient rat converted almost 80 per cent of administered tryptophan-3a, 7a, 7-C^{14} to $C^{14}O_2$ within 14 hours.

D-tryptophan was by far the major radioactive component of the urine of normal animals receiving DL-tryptophan-7a-C^{14}; however, the pyridoxine deficient rat excreted both isomeric forms in about equal amounts. In this animal indoleaceturic acid-C^{14} was excreted in quantities almost as great as DL-tryptophan and was also present as a major component of normal urine.

Microfilm $2.00; Xerox $4.80. 94 pages.

GROWTH AND METABOLISM OF ESCHERICHIA COLI ON ACETATE AS THE SOLE SOURCE OF CARBON

(L. C. Card No. Mic 59-1466)

Alvin Jerald Glasky, Ph.D.
University of Illinois
Chicago Professional Colleges, 1958

The main pathway for acetate metabolism in Escherichia coli grown on acetate as the sole source of carbon was studied. It was felt that the most fruitful approach to the problem of growth of microorganisms on acetate should be one in which intact cells were employed. It would seem plausible to first establish the physiological significance of a series of reactions and then seek detailed information at the enzymatic level.

Classical growth studies have shown that the acetate-adapted cultures could grow on glucose, lactose, acetate and malate without any lag period. The lack of growth on citrate, glutamate, succinate and tartrate was attributed to permeability barriers. The rate of oxygen consumption and carbon dioxide production from acetate were less than that necessary for the complete oxidation of acetate to carbon dioxide and water. This data as well as the appreciable growth of the bacteria on acetate as a sole source of carbon were evidence for the conversion of acetate to cellular material.

Suitable cultures of adapted microorganisms were allowed to metabolize acetate-1-C^{14} or acetate-2-C^{14} for short periods of time and the flow of radioactivity through various cellular metabolites was followed. The radioactive

data obtained after isolation of the various intermediates was subjected to two different types of kinetic analysis. First, the determination of the change in percent distribution of total radioactivity in metabolic intermediates as a function of time and secondly, the change in specific activities of key metabolic intermediates as a function of time.

The rate of incorporation of radioactivity from acetate-1-C^{14} into the carboxylic acids was initially greater than into the amino acids. However, in the experiments with longer incubation times, the amino acids accumulated the major portion of the incorporated radioactivity. Upon further resolution of the individual intermediates, it was found that acetyl-CoA, acetyl-glutathione and succinate showed a decrease with time in percent of total incorporated radioactivity. The percent of radioactivity in malate and isocitrate increased with time. Thus, by the first criterion, succinate appeared to be the earliest stable intermediate formed from acetate.

Determination of specific activities of the key intermediates would eliminate the possibility that succinate trapped a significant amount of the incorporated radioactivity by virtue of its having a large pool size since a large pool size would not be compatible with a high specific activity. The data obtained showed the specific activity of succinate to be 200 times that of malate and isocitrate. The fact that the major portion of the total radioactivity incorporated into the cell was found in succinate and the fact that succinate exhibited specific activity relationships that are compatible with its being formed prior to malate and isocitrate are cogent evidence to support the conclusion that succinate is the first stable intermediate detectable under the experimental conditions employed.

Using a modified isolation procedure and the same type of analysis of the radioactive data obtained, acetyl-CoA and acetyl-glutathione have been implicated as early intermediates of acetate incorporation. The data obtained for malate and isocitrate have eliminated the operation of the "glyoxylate by-pass" in the present system.

On the basis of the results of the present experiments a scheme for acetate metabolism was proposed. It involved the activation of 2 molecules of acetate, via acetyl-CoA and acetyl-glutathione, prior to the oxidative condensation to succinate. Succinate thus formed could undergo the reactions of the tricarboxylic acid cycle and thus lead to the net formation of carbohydrates and amino acids.

Microfilm $2.00; Xerox $4.20. 78 pages.

A COMPARISON OF THE RIBONUCLEIC ACID AND DEOXYRIBONUCLEIC ACID CONTENT OF THE MURPHY-STURM LYMPHOSARCOMA DURING GROWTH AND REGRESSION

(L. C. Card No. Mic 59-386)

George Mohn Homer, Ph.D.
The Ohio State University, 1958

The ribonucleic acid and deoxyribonucleic acid content of the Murphy-Sturm lymphosarcoma in the rat were compared during the progressive and the spontaneously regressive stages of growth. Growing rats were inoculated with this tumor in the axilla, the groin, or the dorsal-lateral aspect of the lumbar region and then sacrificed at varying stages of tumor development. Progressive tumors were defined as those demonstrating successive increases in tumor volume. Regressing tumors were defined as those demonstrating two successive decreases in tumor volume concomitant with continued increases in total body weight.

The tumors were homogenized in a 2.4 M sucrose solution following the removal of any necrotic material. The homogenates were either analyzed directly or separated into a nuclear and a cytoplasmic fraction by an ultracentrifugation technique. The nucleic acids were separately isolated from the whole or the fractionated homogenates by means of the Schmidt-Thannhauser procedure. The ribonucleic acid (RNA) and the deoxyribonucleic acid (DNA) present in the perchloric acid extracts resulting from this separation were measured at 260 mμ and 265 mμ respectively in a spectrophotometer. The nucleic acid content of each extract was estimated in terms of standards prepared from purified yeast sodium ribonucleate and from calf thymus deoxyribonucleic acid.

The nuclei from homogenates of regressing tumors were not obtainable in sufficient quantity to permit a satisfactory analysis for either RNA or DNA. The analyses of the nuclei for RNA and DNA of progressing tumors provided data which were used to calculate the nuclear RNA present in the tumors.

The data thus obtained were examined statistically to determine whether any appreciable differences existed in the nucleic acid content of progressing and regressing tumors. A significant (5 per cent probability level) difference was found in the variation of total DNA per tumor with tumor weight for progressing and regressing tumors. The difference in the variation of these two components (DNA and tumor weight) was estimated as approximately seven milligrams of DNA per gram of tumor tissue more for progressing tumors than for regressing tumors. A similar comparison of the variation of total RNA per tumor with tumor weight for progressing and regressing tumors indicated no significant difference between the two. A further statistical analysis, however, indicated a significant difference in the RNA concentration of progressing and regressing tumors.

When the variation of RNA concentration with DNA concentration for progressing and regressing tumors was compared, no significant difference between the two tumors was found.

The nucleic acid content of the Murphy-Sturm lymphosarcoma in the rat was found to be comparable to the nucleic acid content of other tumors in rats reported previously by other investigators. These findings appear to substantiate reports in the literature that alterations in the nucleic acid content are indicative of alterations in the rate of tissue growth.

Microfilm $2.00; Xerox $7.20. 152 pages.

RIBOSE-5-PHOSPHATE DEGRADATION IN MICROBACTERIUM LACTICUM

(L. C. Card No. Mic 59-535)

Micah Isaac Krichevsky, Ph.D.
University of Illinois, 1958

Sonic extracts of Microbacterium lacticum degrade 1 mole of ribose-5-phosphate with the formation of approximately 1.5 moles of pyruvate, 0.2 mole of alanine, and traces of other unidentified compounds. In this process 0.75 to 1.0 mole of oxygen is consumed.

Appreciable variation of the extract concentration from an optimum value lowers the yield of pyruvate. At lower extract concentrations, addition of magnesium ion and adenosine di- or triphosphate increases the yield of pyruvate to the level obtained with optimum extract concentration.

Dissimilation of ribose-5-phosphate-1-C^{14} yields pyruvate with the following specific activities based upon a value of 100 for the substrate: carboxyl group, 16; carbonyl, 3; and methyl, 37. When pentose-5-phosphate-2,3-C^{14} was the substrate, the resulting pyruvate was labeled predominantly in the carboxyl and carbonyl groups, with the specific activity of the carboxyl group being approximately 2.5 times that of the carbonyl.

It was concluded, on the basis of the data presented, that M. lacticum catabolizes pentose phosphates to pyruvate by a series of reactions catalyzed by the enzymes transketolase, transaldolase, phosphofructokinase, and the enzymes of the Embden-Meyerhof-Parnas glycolytic pathway.

It was further concluded that the completeness of conversion of pentose to pyruvate is dependent on the presence, in adequate amounts, of adenosine triphosphate which is necessary for the phosphorylation of fructose-6-phosphate. Microfilm $2.00; Xerox $5.80. 119 pages.

STUDIES ON THE METABOLISM OF POLYCYCLIC AROMATIC CARCINOGENIC HYDROCARBONS

(L. C. Card No. Mic 59-1171)

John Arthur LaBudde, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Charles Heidelberger

Two metabolites of 1,2,5,6-dibenzanthracene excreted by rabbits after administration of this polycyclic hydrocarbon have been characterized by synthesis as 2'-hydroxy- and 2',6'-dihydroxy-1,2,5,6-dibenzanthracene. In addition, derivatives of 4,8-dihydroxy- and 4,7-dihydroxy-1,2,5,6-dibenzanthracene have been prepared, and a new synthesis of 3,7-dihydroxy-1,2,5,6-dibenzanthracene is described. All the monohydroxy isomers of 1,2,5,6-dibenzanthracene are now known as the result of the synthesis of four new monohydroxy derivatives of the hydrocarbon.

Studies have been continued on the characterization of protein-bound 1,2,5,6-dibenzanthracene-9,10-C^{14} isolated from mouse skin following topical application of the hydrocarbon. After exhaustive hydrolysis of the skin proteins, and a purified gelatin fraction derived therefrom, with a series of proteolytic enzymes, almost one-half of the bound hydrocarbon remained in the enzyme-soluble protein fractions. The enzymatically solubilized portion of the skin proteins was subjected to various fractionation procedures as well as treatment with ninhydrin, 2,4-dinitrofluorobenzene and 12 N hydrochloric acid. Evidence was obtained which indicated that the majority of the bound hydrocarbon in the solubilized material remained attached to relatively large molecules.

It was found that peracetic acid treatment of protein-bound 1,2,5,6-dibenzanthracene released about 25% of the hydrocarbon metabolites from the skin protein, probably by oxidative degradation.

Analyses of various fractions of the enzymatically degraded protein-bound 1,2,5,6-dibenzanthracene did not show any correlation between the quantity of bound hydrocarbon and the concentration of ribonucleic acid, deoxyribonucleic acid or polysaccharide in the fractions assayed.

Different fractions of protein-bound 1,2,5,6-dibenzanthracene were degraded with p-toluene sulfonic acid and a direct correlation was observed between the amount of acid-insoluble humin formed and the proportion of bound hydrocarbon recovered in the humin. In the case of partially purified keratin-bound 1,2,5,6-dibenzanthracene-9,10-C^{14}, after p-toluene sulfonic acid treatment almost all of the radioactivity was recovered in the humin fraction. Humin formation was abolished by carrying out the hydrolysis in the presence of mercaptoacetic acid.

A new one-step synthesis of 2-phenylphenanthrene-3,2'-dicarboxylic acid from 1,2,5,6-dibenzanthracene is described, and a third method of synthesis of this acid has been developed as part of an effort to obtain 1,4-dimethyl-2-phenylphenanthrene-3,2'-dicarboxylic acid. The dialdehyde corresponding to the latter compound has been prepared and its oxidation has been studied.

Preliminary studies of the hydrazinalysis of protein-bound 9,10-dimethyl-dibenzanthracene-9,10-C^{14} have been carried out, and one-half of the bound hydrocarbon is converted to derivatives soluble in ethyl acetate, as contrasted to 25% with 1,2,5,6-dibenzanthracene.

Microfilm $2.00; Xerox $5.80. 118 pages.

BIOPHYSICAL AND BIOCHEMICAL STUDIES OF SQUASH MOSAIC VIRUS AND RELATED MACROMOLECULES

(L. C. Card No. Mic 59-1175)

Horace Michael Mazzone, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Paul Kaesberg

The three components found in Squash Mosaic Virus preparations were separated by sucrose density gradient centrifugation. Molecular weights determined by sedimentation and diffusion data reveal the top sedimenting component to have a value of 4.30 million. The values for the middle and bottom sedimenting components were 6.87 and 9.15 million, respectively.

Ultraviolet absorption indicated the middle and bottom components to be nucleoproteins. The nucleic acid content of the middle component was 32% and for the bottom

component, 38%. The top component had a nucleic acid content of 3%. The nucleic acid in these particles was determined to be ribonucleic acid.

X-ray scattering showed the bottom component to be a relatively dense particle. The top component is a hollow particle, and the middle component is less dense than the bottom component and has a hole in it. The X-ray data indicated that each component was approximately spherical and had a diameter of 325A.

Air dried preparations of the separated components examined in the Electron Microscope revealed the three components to be circularly contoured in shape with a diameter of 350A.

The three components were found to be serologically related and resistant to reagents and conditions known to alter microsomal structure.

Microfilm $2.00; Xerox $3.00. 57 pages.

DIET AND CHOLESTEREMIA: EFFECT OF VARIOUS NUTRITIONAL FACTORS ON SERUM CHOLESTEROL CONCENTRATION IN THE RAT

(L. C. Card No. Mic 59-1420)

Narindar Nath, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Alfred E. Harper

The first part of the investigation was undertaken to develop a diet suitable for studying the effects of nutritional factors on cholesteremia in the rat.

A high level of hydrogenated coconut oil in the diet had little effect on serum cholesterol, but it enhanced essential fatty acid deficiency.

Exclusion of pyridoxine from the diet caused a slight elevation of serum cholesterol concentration and a severe growth inhibition.

Feeding of cholesterol led to an appreciable elevation in serum cholesterol concentration and enhancement of essential fatty acid deficiency. The further addition of cholic acid to this diet caused a still greater rise in serum cholesterol concentration. The relative proportions of cholesterol and cholic acid in the diet determined the serum cholesterol concentration obtained, with cholic acid exerting the greater hypercholesteremic effect. Corn oil added to this diet at a level of 1% reduced the accumulation of serum cholesterol.

There was a considerable elevation of serum cholesterol concentration when thiouracil was also included in the diet, however, thiouracil caused a severe growth depression and the inclusion of 1% of corn oil in the diet containing thiouracil was without effect on the serum cholesterol concentration.

A diet containing 25% of hydrogenated coconut oil, 1% of cholesterol and 0.5% of cholic acid was selected as suitable and was used for the study of dietary factors affecting serum cholesterol concentration in the rat. β-sitosterol added to this diet diminished the accumulation of serum and liver cholesterol; and this effect depended upon the quantity of β-sitosterol added. Calciferol and Q275 when fed to rats had no significant effect on serum cholesterol concentration, but calciferol caused an increase in the deposition of cholesterol in the liver. Diets containing dextrin produced the same degree of hypercholesteremia as did those containing comparable levels of sucrose. However, when sucrose was replaced in part with lactose or sorbitol the hypercholesteremia was enhanced. Nicotinic acid fed at .5% level and inositol-hexa-nicotinate fed at .57% level failed to lower serum cholesterol concentration.

The effects of different dietary levels of several proteins on the serum cholesterol concentration of the rat were determined. With diets containing casein, serum cholesterol concentration was lowest when the protein level was 30-40%. The cholesteremic effects of fibrin and pork were similar to that of casein. Zein exerted a marked hypercholesteremic effect which could be counteracted by replacing it in part with casein. A soybean protein (Drackett) fed at high levels led to lower, and fed at lower levels, led to higher serum cholesterol concentrations than were observed with comparable levels of casein.

Wheat gluten fed to rats on a hypercholesteremic regimen caused a marked lowering of serum cholesterol concentration. However, when cholesterol and cholic acid were excluded from the diet, the substitution of wheat gluten for casein as the dietary protein caused a rise in serum cholesterol concentration. Extraction of wheat gluten with absolute ethanol led to the separation of lipid-like material possessing cholesterol-lowering activity. The extracted wheat gluten had a marked hypercholesteremic effect.

This lipid was resistant to extraction with ether-petroleum ether-acetone mixture. It could be extracted with hot n-butanol. The butanol-extract was separated into an acetone-soluble and an acetone-insoluble fraction and both of these fractions possessed cholesterol-lowering activity. Fatty acids separated from acetone-soluble fraction also were active. Some properties of the lipid material are described. Microfilm $2.00; Xerox $6.60. 140 pages.

STUDIES ON THE GLYCOGEN CONCENTRATION OF THE ADRENAL GLAND IN THE GUINEA PIG AND THE ALBINO RAT UNDER VARIOUS CONDITIONS OF NUTRITION AND METABOLISM

(L. C. Card No. Mic 58-5169)

Nancy Lee Noble, Ph.D.
Emory University, 1953

The purpose of this investigation was to study the occurrence and behavior of adrenal glycogen under various conditions which are known to alter the concentration of the polysaccharide in other tissues and which also affect the activity of the adrenal gland. It was thus sought to extend our knowledge of the occurrence and behavior of glycogen in animal tissues, and, perhaps also to contribute to the biochemistry of the adrenal gland.

A sensitive and reproducible procedure for the isolation of 40 to 80 micrograms of glycogen and the subsequent colorimetric assay of 20 to 40 micrograms of glycogen was developed for the determination of glycogen in the adrenal gland of the guinea pig and the albino rat.

The adrenal glycogen in the guinea pig was first investigated. The adrenal glycogen concentration was statistically greater in the 24-hour fasted normal guinea pig than

in the non-fasted animal, but the actual difference in concentration was small. Vitamin C deficiency produced no significant change in adrenal polysaccharide. The adrenal of the guinea pig was found to contain approximately 25 mg. of glycogen per 100 gm. of fresh adrenal gland, and this value proved remarkably constant among individual animals. After prolonged treatment with ACTH, a significant increase in adrenal glycogen was found, but one may question whether this change in adrenal glycogen concentration can be attributed to an effect of ACTH since neither a decrease in adrenal ascorbic acid nor an increase in liver glycogen was observed following the series of ACTH injections.

Since the amounts of adrenal glycogen encountered in the guinea pig were small and the variations therein induced slight, the investigation was directed toward another species, in which preliminary work indicated the presence of higher concentrations of adrenal glycogen, and in which, therefore, it was hoped that differences of higher magnitude could be induced. The remainder and major portion of the investigation was carried out on the young, adult, male, albino rat. Values for total glycogen of the rat adrenal were established in the fasting and fed states, the effects of various "stress" stimuli were studied, and two fractions of adrenal glycogen were determined.

The concentration of adrenal glycogen after 8, 24, or 48 hours of fasting ranged from 175 to 200 mg. per cent, with a mean of 183.8 ± 4.6 (S. E.) mg. per cent. This concentration was significantly decreased by ad libitum feeding, by oral administration of 1.5 gm. of glucose, or by intraperitoneal injection of 200 mg. of either glucose or fructose to the fasted rat. Oral administration of fructose failed to alter the fasting level of adrenal glycogen, presumably because of incomplete absorption of this hexose.

The administration of 1 mg. of purified growth hormone per 100 gm. of body weight during the 24 hours prior to sacrifice was without effect on adrenal glycogen concentration in either the 24-hour fasted or the non-fasted rat.

Conditions recognized as imposing stress on the organism, such as exposure to cold for the 3 terminal fasting hours or traumatic injury of 0.5 or 1.5 hours' duration, produced a significant decrease in the fasting concentration of adrenal glycogen. Exposure to cold throughout the 24-hour period of fasting apparently resulted in adaptation to the "stress," and, therefore, no alteration in concentration of adrenal polysaccharide.

Intraperitoneal injection of the equivalent of 1 mg. of ACTH per 100 gm. of body weight 3 hours prior to sacrifice resulted in a significant decrease in the fasting concentration of adrenal glycogen. Intraperitoneal or subcutaneous injection of 0.02 mg. of epinephrine per 100 gm. of body weight 3 hours prior to sacrifice brought about a similar fall.

Intraperitoneal injection of 0.2 Units of insulin per 100 gm. of body weight decreased adrenal glycogen in the fasted rat to the lowest level observed, which was only 30% of the fasting concentration. Simultaneous administration of glucose with the insulin prevented the severe decrease in adrenal glycogen caused by insulin, and resulted in a value of the same order as that observed after glucose administration to the fasted rat.

The total glycogen of the rat adrenal was shown to consist of two fractions: one easily extracted with trichloracetic acid and a fraction insoluble in trichloracetic acid. (These two fractions had been shown previously by others in this laboratory to occur in liver and muscle.) The TCA-soluble fraction accounted for about 50% of the total (KOH) adrenal glycogen in the fasted, the non-fasted, or the epinephrine-injected rat, but for only 20% of the adrenal polysaccharide in the insulin-injected animal. Approximately 70% of the decrease observed in the fasting concentration of total adrenal glycogen following ad libitum feeding, administration of epinephrine or injection of insulin was found to occur in the TCA-soluble fraction.

Parallel determinations of adrenal cholesterol and ascorbic acid demonstrated that the cholesterol concentration is decreased by fasting, although ascorbic acid concentration is unaltered. Both cholesterol and ascorbic acid of the adrenal were decreased following the injection of insulin. These findings agree with reports in the literature of similar studies.

No direct correlation was apparent between glycogen concentration in the liver and in the adrenal under the experimental conditions studied; nor do the alterations observed in adrenal glycogen conform consistently to the pattern of behavior reported for any other tissue glycogen. The results of this investigation suggest that the behavior of the glycogen in the adrenal gland is related to adrenocortical activity rather than to the behavior of the polysaccharide in other tissues. Such a relationship is indicated by a comparison of our observed changes in adrenal glycogen concentration with reported changes in adrenal ascorbic acid and cholesterol under similar experimental conditions.

Adrenal glycogen concentration probably decreases as the pituitary-adrenal system is stimulated and adrenocortical activity is increased, resulting in hormone synthesis and elaboration. Although the function of glycogen in the adrenal gland of the guinea pig, the albino rat, and other species can be established definitely only after further investigation, several hypotheses as to the possible function of the polysaccharide in the adrenal are proposed and discussed: (1) adrenal glycogen may supply the energy required for the production and elaboration of the adrenocortical hormones; (2) adrenal glycogen may furnish the energy required for the increased cellular activity in the gland under conditions which stimulate release of adrenocorticotrophin from the anterior pituitary or following exogenous ACTH administration; (3) adrenal glycogen or its breakdown products may be directly involved in the synthesis of adrenal cholesterol and/or ascorbic acid, either as precursor material or as reactants in the oxidation-reduction processes of synthesis.

Microfilm $3.45; Xerox $11.80. 268 pages.

AN EQUATION FOR THE TITRATION CURVE OF AMINO ACIDS, PEPTIDES, AND PROTEINS

(L. C. Card No. Mic 59-1448)

Gordon Lee Nordby, Ph.D.
Stanford University, 1959

Supervisor: J. Murray Luck

The ionization of an amino acid, peptide, or protein is ideally described in terms of the ionizations of its constituent acidic groups. For the relatively simple structures of amino acids and short peptides, this ideal is attained

with moderate ease by conventional methods of graphic analysis of titration data. For the usually complex long peptides and proteins, however, it is not possible to describe ionizations in terms of the ionizations of constituent acidic groups. Instead, for purposes of the graphic analysis, it must be assumed that the ionization of these complex structures can be adequately described in terms of the ionization of a small number of classes of acidic groups. It is assumed that all acidic groups in a class behave as if they have the same intrinsic dissociation constant and that the dissociation constant of each class is independent of the dissociations of all other classes. Somewhat antithetical to these assumptions is the further assumption that any charges carried by an acidic group are uniformly distributed over the surface of the molecule. However, if the ionization of a protein is, in fact, to be described in terms of the ionizations of its constituent acidic groups, then the individual contribution of each group must be recognized and each ionization must be considered as taking place at a definite geometric position which may act as a charge locus.

The dissertation represented by this abstract considers the problems of computing the real dissociation constant for each acidic group of an n-functional acid. An equation is developed which represents the titration curve of the n-functional acid in terms of the hydrogen-ion concentration, the number of undissociated acidic groups in the complex acid, and the n different dissociation constants of the acid. The equation is solved by suitable numerical analysis techniques to provide a system of n simultaneous equations which represent discrete points on the titration curve. The simultaneous equations are solved by suitable computer techniques on an IBM 650 digital computer. Since for this algebraic analysis only n data points are required for the solution of the n simultaneous equations, there is considerable advantage in this method compared to the conventional graphical methods which require innumerable data points. In addition, statistical and procedural advantages in the algebraic method of analysis are discussed.

The indicated analytical technique is tested by several models. For the models used, correct dissociation constant values were obtained with an accuracy and resolution exceeding four decimal places on the log scale in which the pK values are computed. Actual data for the peptides glycyl-glycine, glycyl-tyrosine, glycyl-aspartic acid, and histidyl-histidine yield values in close agreement with literature values. Similarly, titration data for beef insulin yield 16 dissociation constant values corresponding to the 16 acidic groups in the insulin monomer. These are compared to the 6 class dissociation constants, for the same molecule, which appear in the literature as consequences of the graphic analysis of titration data.

Microfilm $2.00; Xerox $6.20. 130 pages.

STEROID HYDROXYLATION IN MICROBIAL AND ADRENAL SYSTEMS

(L. C. Card No. Mic 59-551)

Robert Elwood Ober, Ph.D.
University of Illinois, 1958

An assay for steroid hydroxylation based on chromatographic separation of tritium-labeled steroids has been developed. A tritium-labeled substrate, prepared by exposure to tritium gas (Wilzbach, K., J. Am. Chem. Soc., 79, 1013 (1957)) is added to an incubation mixture. After incubation the steroids are extracted and separated into substrate and product fractions by paper chromatography. The amount of substrate and product(s) can be measured either by scanning the paper strips and measuring areas under tracing peaks or by eluting the steroids from the paper and counting by liquid-scintillation techniques. A Nuclear Chicago Model D-47 counter from which the end-window had been removed was used at 25 psi of counting gas pressure for the strip scanning technique. There is good agreement between the scanning and elution techniques if both sides of the paper strip are scanned. The high sensitivity of the elution technique, even in crude incubation systems, makes possible incubation times of the order of fifteen minutes.

The previously demonstrated TPNH requirement for steroid hydroxylation in extracts of acetone-dried beef adrenal mitochondria was confirmed; TPNH added as such or generated in situ were about equally effective. Diethyldithiocarbamate at a concentration of 10^{-3} M. inhibited hydroxylation by the TPNH-supplemented adrenal mitochondrial extract.

Observation of a lag in conversion of 11-deoxycorticosterone (DOC) to more polar products in extracts of Curvularia lunata led ultimately to the isolation of a steroid hydroxylating bacterium from the environment. Growing cultures and washed cell suspensions of this organism, identified as Bacillus cereus, can hydroxylate DOC. The principal products, identified by paper chromatography in two solvent systems, were the 6β, 11α, 14α and 15α monohydroxylated derivatives of DOC. The compound corresponding to 14α-hydroxy DOC was isolated and identified as a hydroxylated derivative of DOC by elemental analysis and infrared spectroscopy. Cell suspensions of B. cereus also convert progesterone and 17α-hydroxy-deoxycorticosterone (compound S) to products which behaved chromatographically like hydroxylated derivatives. McAleer, et al, (Arch. Biochem. Biophys., 73, 127 (1958)) have recently reported steroid hydroxylation by B. cereus and B. megatherium. Attempts to obtain hydroxylation in supplemented broken-cell preparations of B. cereus were unsuccessful. Hughes press, alumina grinding and sonication were used to break the cells; TPNH, DPNH, menadione and tetrahydrofolic acid were used as supplements.

Cell suspensions of Bacillus megatherium, strain KM, were shown to convert DOC to products which behaved chromatographically like hydroxylated derivatives. A suggestion of hydroxylating activity was obtained in a system containing lysozyme-ruptured B. megatherium cells, TPNH, DPNH, cyanide and rat liver extract. Various combinations of TPNH, DPNH, tetrahydrofolic acid and CN^- were ineffective as supplements in this system. It is anticipated that further investigation of cell-free systems obtained by lysozyme treatment of B. megatherium will

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

lead to information concerning the mechanism of enzymatic steroid hydroxylation.

Microfilm $2.00; Xerox $3.60. 65 pages.

ENERGY COUPLED ELECTRON TRANSPORT IN CLOSTRIDIUM KLUYVERI

(L. C. Card No. Mic 59-576)

Charles Willard Shuster, Ph.D.
University of Illinois, 1958

Soluble extracts of Clostridium kluyveri catalyze the overall anaerobic reaction: (1) Crotonyl-CoA + H_2 → Butyryl-CoA. Evidence is offered for an oxidative formation of high energy phosphate coupled with this electron transport process. The electron donor may be either molecular hydrogen, reduced diphosphopyridine nucleotide, or reduced flavin adeninedinucleotide. Crotonyl-CoA may be replaced by 2-alkenoic thioesters of N-acetyl thioethanolamine. In the energy coupled oxidation, ATP formation has been measured by conversion of glucose to 6-phosphogluconate with added hexokinase and Zwischenferment. Approximately 1 mole of ATP is detected for each mole of 2-alkenoic thioester reduced. Addition of orthophosphate-P^{32} yielded ATP labeled almost exclusively in the terminal phosphate, indicating ADP to be the phosphate acceptor. ATPase was not detectable in the extracts and adenylic kinase activity was low.

In the absence of electron donors, the dismutation, (2) 2 Crotonyl-CoA → Butyryl-CoA + 2 Acetyl-CoA, occurs, permitting a net ATP synthesis via the phosphotransacetylase and acetokinase reactions of acetyl-CoA. In the presence of a hydrogen donor, however, an equivalence of butyryl thioester formed with hydrogen oxidized indicates that crotonyl oxidation (reaction 2) does not compete effectively with external electron donors to generate ATP via acetyl-CoA formation. The validity of the crotonyl-CoA dismutation is verified by the ability of the organism to grow anaerobically at the expense of crotonic acid as a sole source of carbon and energy.

The enzymes of the electron transport system have been fractionated and ethylene reductase, hydrogenase, and diaphorase activities partially purified. Both diaphorase and hydrogenase possess the ability to reduce free flavin nucleotides, and reduced flavin will serve as electron donor in the ethylene reductase reaction as well as reduced DPN; in addition, the presence of free flavin effects an apparent uncoupling of the phosphorylation reaction. Several alternate flavin-mediated pathways of hydrogen transport, at least one of which is not coupled and may be regarded as a by-pass mechanism, are postulated to be functional in the energy metabolism of C. kluyveri. Attempts at reconstitution of the complete system from hydrogen to crotonyl-CoA from partially purified enzymes yielded equivocal results due to the failure of hydrogenase preparations to reduce pyridine nucleotides.

The properties of the isotopic exchange of inorganic phosphate for the terminal phosphate of ATP and the exchange of ADP for ATP have been studied in relation to the mechanism of coupled phosphorylation. The two exchange mechanisms appear to represent different enzymes associated with the phosphorylating activity. The partially purified ATP-Pi exchange is sensitive to sodium azide and ADP in concentrations equivalent to ATP. The ADP-ATP exchange appears to be stimulated by reduced DPN and is insensitive to high concentrations of azide and 2,4-dinitrophenol. Purified fractions containing ATP-Pi exchange activity correspond to a flavoprotein also catalyzing the oxidation of DPNH.

Microfilm $2.00; Xerox $5.00. 96 pages.

THE CHEMISTRY OF FILIPIN

(L. C. Card No. Mic 59-578)

James Howard Sloneker, Ph.D.
University of Illinois, 1958

Filipin was subjected to various hydrolysis, reduction and oxidation procedures. Basic hydrolysis resulted in opening of a lactone ring and the production of a biologically inactive acid. Filipin was reduced readily over various catalysts giving amorphous products. Attempts to obtain a crystalline perhydro derivative were not successful. Periodate oxidation of the basic hydrolysis product of filipin resulted in a 1 mole uptake of periodate with cleavage of the molecule into two large fragments.

A material was isolated from a hexane extract of carrots which prevents the inhibition of growth of Penicillium oxalicum by filipin. This material was identified as a mixture of plant sterols. Cholesterol was shown to be equally as effective as the sterols isolated from carrots in antagonizing filipin inhibition.

The mechanism of inhibition by filipin has been studied on a strain of Saccharomyces cerevisiae and on Bakers' yeast. The results show that filipin is a strong inhibitor of both respiration and endogenous respiration, but gives little or no inhibition of the oxidation of α-ketoglutarate by isolated yeast mitochondria. Cells, normally unable to utilize succinate as a substrate, oxidized succinate at a rate 1/6 that of the sucrose when exposed to filipin in a hypertonic sucrose medium. Up to 40 per cent of the total phosphorus and 17 per cent of the total nitrogen was "leaked" from the cell into the medium upon incubation for 4 hours in a medium containing filipin. A material which had an ultraviolet absorption maximum of 260 mu appeared in the incubation medium 5 minutes after the cells were exposed to filipin. The amount of this material in the medium was proportional to the length of exposure and to the concentration of filipin. The inhibition of respiration and endogenous respiration and the leaking of nitrogen, phosphorus, and the ultraviolet absorbing material into the medium can be prevented by the addition of cholesterol simultaneously with the addition of the antibiotic to the incubation medium.

The effects of filipin on tissue homogenates and liver mitochondria of rats were studied. Little or no inhibition of liver homogenates, heart homogenates, liver mitochondria, and liver succinic dehydrogenase was observed at filipin concentrations four times that used for the inhibition of whole yeast cells.

A tentative hypothesis has been advanced for the mechanism of the inhibitory effect of filipin on yeast cells.

Microfilm $3.20; Xerox $11.00. 248 pages.

PREPARATION, PURIFICATION AND CHARACTERIZATION OF SEVERAL AMINO ACID DERIVATIVES OF ETHANOLAMINE

(L. C. Card No. Mic 59-774)

Elizabeth Cooke Smith, Ph.D.
The Pennsylvania State University, 1958

The synthesis, purification and characterization of several amino acid derivatives of ethanolamine was undertaken. N-Glycylaminoethanol was synthesized by the following methods: 1) reaction of chloroacetyl chloride with ethanolamine, followed by animation of the intermediate by means of reaction with ammonium hydroxide; 2) reaction of monochloroacetic acid with ethanolamine, followed by amination by reaction with ammonium hydroxide; 3) reaction of phthaloylglycine with ethanolamine in the presence of N,N'-dicyclohexylcarbodiimide, followed by removal of the phthaloyl group by means of the reaction with hydrazine hydrate; and, 4) reaction of trifluoroacetyl glycine with ethanolamine in the presence of N,N'-dicyclohexylcarbodiimide. In this case, the trifluoroacetyl blocking group was removed by the presence of ethanolamine. In spite of the fact that N-glycylaminoethanol was shown to be present in each of the above synthetic mixtures, this compound could not be obtained in pure form.

N-Phthaloylglycylaminoethanol was prepared in 24% yield by the carbodiimide method of synthesis. Despite the low yield, this procedure was considered desirable for two reasons: 1) a pure product can be obtained solely by recrystallization and 2) the by-product, dicyclohexyl urea, can be reconverted to the carbodiimide for use in another synthesis. Preliminary experiments would indicate that this method of synthesis may also be adapted to the production of N-phthaloylalanylaminoethanol and N-phthaloylglycylglycylaminoethanol.

N-Phthaloylglycylaminoethanol was characterized by formation of an acetate derivative, by reaction with nitrous acid, by infrared spectrum and by percent nitrogen. This compound exhibited peculiar properties when treated with alcoholic hydrogen chloride. Although the aminoacyl shift characteristic of amide or ester derivatives of ethanolamine may be occurring, the experimental evidence is insufficient to permit drawing this conclusion.

Paper electrophoresis was found to be a tool of great importance in evaluating the synthesis, isolation and purification of glycine derivatives of ethanolamine. However, a major disadvantage was encountered in the use of this technique. The presence of certain hydroxides (barium, potassium, sodium and lithium) in the sample which was subjected to electrophoresis led to the formation of an anomalous yellow spot when the electrophoretograms were developed with ninhydrin reagent. The "yellow compound" exhibited the properties of migration, detection with indicator and elutibility which might be ascribed to a nitrogen-containing compound formed in the synthesis of N-glycylaminoethanol. Microfilm $2.00; Xerox $5.40. 108 pages.

THE RADIOCHEMICAL IDENTIFICATION OF THE MAJOR SULFOLIPID IN PLANTS

(L. C. Card No. Mic 59-784)

Robert Wiser, Ph.D.
The Pennsylvania State University, 1958

A sulfolipid occurs in high concentration in photosynthetic organisms. The purpose of this thesis was the elucidation of the chemical structure of this lipid. It was readily labeled with S^{35} or C^{14} by Chlorella, and isolated by paper chromatography. Radiochemical identification of the sulfolipid showed it to be 1-O-(3'-acyl-1'glyceryl)-beta-D-galactopyranose-6-sulfate. This sulfolipid contained as much as eighty per cent of the S^{35} radioactivity in alcohol extracts of sulfur-labeled Chlorella, and was found in every photosynthetic organism examined. Theoretical considerations are discussed.

Microfilm $2.00; Xerox $3.00. 51 pages.

MONOAMINE OXIDASE IN RELATION TO THYROID HORMONES

(L. C. Card No. Mic 59-1419)

Maija Helene Zile, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Henry A. Lardy

Monoamine oxidase, an enzyme involved in catabolism of biologically active amines, has been studied in this work. Although this enzyme is widely distributed in nature, its physiological significance is still controversial. Evidence is available that monoamine oxidase degrades sympathomimetic amines. The finding that the metabolic effects of sympathomimetic amines are augmented by thyroid hormone has suggested that monoamine oxidase activity may be influenced by thyroid hormone. In an attempt to clarify this point, a study has been made of monoamine oxidase in livers of normal, thyroidectomized and thyroid-fed rats.

First, it was necessary to study the properties of this enzyme and to develop a reliable assay for it. A colorimetric reaction using nitrosonaphthol was found to be best suited for the estimation of monoamine oxidase activity by substrate disappearance. Monoamine oxidase was found to be relatively stable at the conditions selected for incubation and storage of the enzyme preparation. Tyramine degradation by monoamine oxidase was unaltered by DPN, TPN, DPNH, TPNH and vitamin B_6. Preliminary experiments revealed that the addition of FMN or FAD caused a decrease in the oxygen uptake during the degradation of tyramine by monoamine oxidase. A diphosphopyridine nucleotide-dependent dehydrogenase activity was demonstrated in washed mitochondria from rat liver. Relative specific activities of monoamine oxidase were determined for tyramine, serotonin, and tryptamine. The specific activity with tyramine as substrate was 1.5- and 1.7-fold higher than with tryptamine and serotonin, respectively. The kinetics of tyramine degradation by monoamine oxidase of fresh hepatic mitochondria was studied. The K_s for the reaction was 4.1×10^{-3}M. High concentrations of tyramine inhibited the reaction. The K_s' was 1.1×10^{-2}M.

Partial solubilization of monoamine oxidase activity was achieved after the sonation of acetone-dried mitochondria. About 13 to 33 per cent of the initial monoamine oxidase activity was found in the supernatant after a high-speed centrifugation.

A comparison of hepatic mitochondrial monoamine oxidase activity of rats in different thyroid states revealed that hypothyroid rats possessed the highest activity and that mitochondria from normal rats oxidized tyramine twice as fast as did those from rats fed thyroid substance. Monoamine oxidase activity declined steadily during thyroid feeding and was restored to normal levels after discontinuance of the treatment. The decreased monoamine oxidase activity in the liver of thyroid-fed rats was not due to direct inhibition of the enzyme by thyroid hormone or other inhibitors in the tissues. The monoamine oxidase was found to be distributed among the various cellular components in the same relative amounts in livers of thyroid-fed rats as of normal rats. From this study it was concluded that thyroid hormone has an indirect effect upon the activity of monoamine oxidase. Thyroid hormone may regulate the biosynthesis of this enzyme or control other enzymes that govern the activity of monoamine oxidase in the liver. Microfilm $2.00; Xerox $3.80. 67 pages.

CHEMISTRY, INORGANIC

OBSERVATIONS ON THE RARE EARTHS: ELECTROCHEMICAL STUDIES INVOLVING ANHYDROUS PYRIDINE AND ACETONITRILE SOLUTIONS

(L. C. Card No. Mic 59-513)

Gynith Colleen Giffin, Ph.D.
University of Illinois, 1958

In this study various physical and electrochemical properties of anhydrous rare earth bromides in anhydrous pyridine and acetonitrile were investigated. Lanthanum bromide was prepared by the reaction of gaseous hydrogen bromide and lanthanum oxide at elevated temperature. The bromides of praseodymium, neodymium, samarium, and gadolinium were prepared by the reaction described by the equation: $Ln_2(CO_3)_3 + 6HBr \xrightarrow[600\text{-}700^\circ C.]{Br_2} 2LnBr_3 + 3CO_2 + 3H_2O$. Lanthanum and praseodymium bromides are known to exhibit isomorphous crystal structure, as do neodymium and samarium bromides. By comparison of x-ray diffraction patterns, gadolinium bromide was shown to possess a third unidentified crystal structure. The bromides are deliquescent solids with high melting points and exhibit colors characteristic of the rare earth ion present.

Solubilities of the anhydrous rare earth bromides were determined in pyridine and acetonitrile. The bromides are moderately soluble in pyridine and slightly soluble in acetonitrile. Crystalline phases of solvated rare earth bromides were formed during the solubility studies. Unfortunately, the pyridine solvated compounds were not completely characterized. The acetonitrile compounds corresponded to the following formula: $LnBr_3 \cdot xCH_3CN$, where x is 3 for La, Nd, and Gd, 4 for Sm, and 5 for Pr. The solubilities of anhydrous calcium, strontium, and barium bromides in pyridine were determined also.

The rare earth bromides were found to be weak electrolytes in both acetonitrile and pyridine. The bromides were better conductors in acetonitrile than in pyridine, which is reasonable in view of the larger dielectric constant of the former solvent. Calcium, strontium, and barium bromides, and neodymium benzoate were found to be weak electrolytes in pyridine.

The absorption spectra of neodymium and praseodymium bromides in pyridine and acetonitrile, as compared with those in aqueous solutions, show slight shifts in wavelengths and changes in the relative intensities of peaks, and in the case of neodymium, resolution of various absorption bands. The spectrum of neodymium benzoate in pyridine exhibited similar changes.

Solutions of the rare earth bromides in pyridine and acetonitrile were investigated as possible systems from which the rare earth metals might be electrodeposited. Electrolyses were performed with both platinum and mercury cathodes. Pyridine solutions of lanthanum and neodymium bromides yielded brown cathode deposits. There was no evidence for deposition of the free metals from this solvent. Electrolyses of lanthanum and neodymium bromides in acetonitrile yielded white and pink cathode deposits, respectively, with no evidence for the reduction of the metal ions. Electrolysis of samarium bromide in acetonitrile gave small amounts of a black cathodic deposit mixed with a yellow precipitate. The black deposit gassed on addition of water, indicating the presence of a reducing species. The exact nature of the black material was not established because of the limited amount obtained and the heterogenity of the deposit.

During the electrolyses in both pyridine and acetonitrile, it was noted that the rare earth metal ion content of the anolyte increased. Anionic species containing neodymium were shown to be present in acetonitrile solutions of neodymium bromide, which would account for the migration of rare earth metal ions to the anolyte. The ratio of neodymium in the cationic state to that in the anionic state in the solution was found to be 1:4.

Microfilm $2.00; Xerox $5.40. 109 pages.

A MONOBORATE ESTER

(L. C. Card No. Mic 59-900)

Sister Mary Mechtilde Hill, R.S.M., Ph.D.
St. Louis University, 1958

Boron in its simple stable compounds is usually either tricovalent with a trigonal-coplanar configuration or tetracovalent-tetrahedral. Tricovalent boron in a nonplanar configuration such as could be the situation in a small ring, bicyclic "cage" compound with boron at the bridge-head should have important stereochemical consequences. To resolve conflicting literature reports on the existence of such highly strained "cage" compounds, a reinvestigation of the synthesis of these compounds was undertaken. The transesterification of a trialcohol with methyl borate affords the possibility of synthesizing the internal triester-the desired bicyclic cage compound-under conditions

approaching optimum: extreme dilution, minimum temperature, and basic solvent.

By the reaction of methyl borate with trimethylolethane in pyridine the desired product was readily obtained as the monosolvate. Its identity was established by boron content, molecular weight, and infra-red spectrum. Isolation of the ester from the solvent appears possible but the compound so obtained readily transforms into high molecular weight, polymeric material. Similar results were obtained in dioxane but polymer formation occurs more readily, often spontaneously and without removal of the solvent.

It is concluded that the internal triester, trimethylolethane borate, can be prepared but it is exceedingly unstable. Because the six-membered rings would result in O-B-O bond angles between 110° and 115° compared to 120° for the stable tricovalent boron boron-element bond system, the maximum distortion of the tricovalent coplanar bonds to be expected in stable systems appears to be about 5°.

Microfilm $2.00; Xerox $5.00. 100 pages.

PHASE STUDIES OF AMMONIATES AND AMINATES OF LITHIUM HYDROBORATE

(L. C. Card No. Mic 59-901)

Dominic Joseph Hunt, Ph.D.
St. Louis University, 1958

This investigation is another in a series of phase studies of hydroborate solvates conducted in this laboratory. Several lithium hydroborate - ether systems and the sodium hydroborate - ammonia system have previously been studied.

The same experimental technique that was employed in this earlier work, that of determining pressure - composition isotherms, has been applied in this investigation to determine the extent of interaction in the systems lithium hydroborate - ammonia, lithium hydroborate - monomethylamine and lithium hydroborate - trimethylamine. Portions of isotherms determined at eleven different temperatures between -35.3° and 55° in the ammonia system demonstrate the existence of four stable ammoniates: a monoammoniate (M.P. 53°), a diammoniate (M.P. 19°) a triammoniate (M.P. 38°), and a tetraamoniate (M.P. > 55°). For the system lithium hydroborate - monomethylamine, parts of twelve different isotherms embracing the temperature range of -45.2° to 55° have been used to show that three monomethylaminates exist: a simple monomethylaminate (M.P. 50°), a tris(monomethylaminate)(M.P. > 55°), and a tetrakis-(monomethylaminate)(M.P. >55°). Only two trimethylaminates have been found to be stable by a study of segments of ten isotherms encompassing the temperature range of -45.2° to 55°: a mono(trimethylaminate) and a bis(trimethylaminate), both of which melt about 55°.

From information provided by the isotherms and from visual observations as to the number and type of phases present at various compositions and temperatures, melting point - composition diagrams have been constructed for the systems lithium hydroborate - ammonia and lithium hydroborate - monomethylamine.

The relative stabilities of the solid ammoniates and aminates have been deduced from the dissociation pressures of these adducts as determined from the isotherms. The standard free energies, enthalpies and entropies of dissociation at 25° which have been calculated from the data also furnish evidence pertaining to the relative stabilities of the observed addition compounds.

These relative stabilities of ammoniates and aminates are discussed from the viewpoint of inductive and steric effects about a bond between the lithium and nitrogen atoms. An attempt has also been made to compare the different systems both with regard to the number of adducts formed in each system and with regard to the melting points of adducts associated to the same degree. The relative melting points of the adducts are interpreted in terms of extent of polarizability of such adducts. This polarizability is believed to be influenced by the added group and modified by the crystal structure of the adduct.

Similar comparisons have also been made between the adducts investigated here and the etherates.

Microfilm $2.00; Xerox $4.20. 80 pages.

A STUDY OF THE REACTION OF BROMINE TRIFLUORIDE AND FLUORINE TO FORM BROMINE PENTAFLUORIDE

(L. C. Card No. Mic 59-1226)

Harris Eudell Kluksdahl, Ph.D.
University of Washington, 1958

The rate of reaction for $BrF_3(g) + F_2(g) \rightarrow BrF_5(g)$ has been studied over the temperature range of 70 to 120° C in a nickel reactor and with the initial pressures varying from 30 to 300 mm. The reaction was found to be bimolecular and to have an activation energy of 16.4 kcal. The observed frequency factor was 2.6×10^{11} cc. $mole^{-1}$ $sec.^{-1}$. This corresponded to a probability factor of 10^{-3}, thus indicating that every bimolecular collision was not effective in producing bromine pentafluoride. Because of the loss of three translational and two rotational degrees of freedom in forming bromine pentafluoride, the slowness is due to the fact that energy transformations have to be made in several degrees of freedom in formation of the activated complex. Some steric orientations may be more favorable for this energy transfer than others. Increasing the nickel surface area 5.5 times gave no change in the specific rate constant, indicating that the reaction was homogeneous. The condition of the nickel surface was very important in obtaining a homogeneous reaction. Runs with a dirty nickel reactor and with a silvered screen in the clean reactor gave evidence that suggested a heterogeneous reaction was occurring in addition to the gas phase reaction.

Evidence was found suggesting that bromine trifluoride is partially associated in the vapor phase. Assuming that the association is to a dimer, the relationship of the equilibrium constant and temperature was found to be given by the expression

$$\log K\,(mm.^{\frac{1}{2}}) = -\frac{1147}{T^{o}K} + 4.95$$

for the reaction

$$\tfrac{1}{2}\,(BrF_3)_2 \rightleftharpoons BrF_3.$$

Microfilm $2.00; Xerox $3.00. 59 pages.

ADSORPTION OF ANTIMONY(III) AND INDIUM FROM ANHYDROUS ACETIC ACID BY ION EXCHANGE RESINS

(L. C. Card No. Mic 58-3511)

Robert Tor Lofberg, Ph.D.
The University of New Mexico, 1958

The adsorption of antimony(III) chloride and bromide and indium chloride and bromide by Dowex-1 and Dowex-50 from anhydrous acetic acid solutions of hydrogen chloride, alkali halides, and potassium acetate was investigated.

Sixty day antimony-124 and fifty day indium-114m were used as tracers to follow the course of the reactions and conventional techniques were used to detect the radiation.

It was found that the acetate form of Dowex-1 was quantitatively converted to the corresponding halide form in hydrogen chloride, lithium chloride, and lithium bromide solutions.

It was suggested that adsorption from acetic acid proceeds via molecular rather than ionic reactions. The adsorption mechanisms postulated below were predicated upon the analyses of plots of log K_d versus log (complexing agents), where K_d is the distribution coefficient.

The following mechanisms were suggested for the adsorption of antimony(III) chloride by Dowex-1 from hydrogen chloride solutions,

1. $SbCl_3 + HCl \rightleftharpoons HSbCl_4$
   $RCl + HSbCl_4 \rightleftharpoons RSbCl_4 + HCl$
2. $SbCl_3 + 2HCl \rightleftharpoons H_2SbCl_5$
   $RCl + H_2SbCl_5 \rightleftharpoons RHSbCl_5 + HCl$
3. $SbCl_3 + 3HCl \rightleftharpoons H_3SbCl_6$
   $RCl + H_3SbCl_6 \rightleftharpoons RH_2SbCl_6 + HCl$

The adsorption of antimony(III) chloride by Dowex-1 from lithium chloride solutions was believed to have occurred via the following mechanism.

$$SbCl_3 + LiCl \rightleftharpoons LiSbCl_4$$
$$RCl + LiSbCl_4 \rightleftharpoons RSbCl_4 + LiCl$$

The adsorption of antimony(III) bromide by Dowex-1 from lithium bromide solutions was represented by a mechanism analogous to that postulated for LiCl.

Neither antimony(III) chloride nor bromide was adsorbed by Dowex-1 from potassium acetate solution. Antimony(III) chloride was not adsorbed by Dowex-50 from hydrogen chloride solutions.

Indium chloride underwent at least partial solvolysis in acetic acid as indicated in the following equation.

$$InCl_3 + HOAc \rightleftharpoons In(OAc)Cl_2 + HCl$$

Since the equilibrium constant for the reaction was not known, the effect of adding hydrogen chloride or lithium chloride could not be predicted. Thus, the true nature of the reacting species could not be stated with certainty.

The adsorption of indium chloride by Dowex-1 was studied as a function of the composition of hydrogen chloride, lithium chloride, potassium chloride, and potassium acetate solutions and of lithium chloride-hydrogen chloride mixtures. Analysis of the data indicated the following mechanisms for the adsorption from hydrogen chloride solutions:

1. $InCl_3 + 2HCl \rightleftharpoons H_2InCl_5$
   $2RCl + H_2InCl_5 \rightleftharpoons R_2InCl_5 + 2HCl$
2. $InCl_3 + 3HCl \rightleftharpoons H_3InCl_6$
   $2RCl + H_3InCl_6 \rightleftharpoons R_2InCl_6 + 2HCl$

The following mechanisms were postulated for adsorption of indium chloride from lithium chloride solutions:

$$In(OAc)Cl_2 + LiCl \rightleftharpoons LiIn(OAc)Cl_3$$
$$RCl + LiIn(OAc)Cl_3 \rightleftharpoons RIn(OAc)Cl_3 + LiCl$$

or

$$InCl_3 + LiCl \rightleftharpoons LiInCl_4$$
$$RCl + LiInCl_4 \rightleftharpoons RInCl_4 + LiCl$$

The suggested mechanism for adsorption of indium from potassium chloride solutions was analogous to that cited for LiCl. The following mechanism was postulated for adsorption of indium from lithium chloride-hydrogen chloride mixtures:

$$InCl_3 + LiCl + HCl \rightleftharpoons LiHInCl_5$$
$$2RCl + LiHInCl_5 \rightleftharpoons R_2InCl_5 + LiCl + HCl$$

Indium chloride was adsorbed by Dowex-50 from hydrogen chloride solutions but not from lithium chloride and potassium acetate solutions.

Indium bromide was adsorbed by Dowex-1 from lithium bromide and potassium bromide solutions. The mechanism for the adsorption was believed to be similar in nature to the indium chloride adsorption from lithium chloride and potassium chloride solutions. Both indium chloride and bromide were adsorbed by Dowex-1 from potassium acetate solutions and an adsorbed species with a valence of -1 was indicated.

It was demonstrated that small traces of water did not appreciably affect the adsorption of antimony(III) chloride and indium chloride from hydrogen chloride solutions.

Microfilm $2.00; Xerox $5.80. 117 pages.

SOME ASPECTS OF THE NON-AQUEOUS CHEMISTRY OF THE URANIUM CHLORIDES

(L. C. Card No. Mic 59-1510)

Richard Earl Panzer, Ph.D.
The University of New Mexico, 1958

The preparation and properties of the compound, $UCl_5 \cdot PCl_5$ have been investigated. The compound is triclinic, occurring in bright red-orange tabular, highly twinned crystals. It was prepared by the reaction between anhydrous uranium trioxide and phosphorus pentachloride. The compound was also prepared by the direct reaction of uranium pentachloride and phosphorus pentachloride.

The compound could not be separated into its constituent molecules, but was found to be ionic, presumably dissociating into the ions, (UCl_6^-) and (PCl_4^+). It is 69.8% dissociated in phosphorus oxychloride at a concentration of 67.5×10^{-3} molal. Dissociation increases with increasing dilution, but complex reactions occur between solute and solvent at high dilutions.

When a solution of the compound (UCl_6^-) (PCl_4^+) in phosphorus oxychloride is electrolyzed it is believed that the following cell reaction takes place:

$$2UCl_6^- + 2PCl_4^+ \rightarrow 2UCl_6 + PCl_3 + PCl_5$$

The uranium hexachloride formed appears to decompose slowly in the reaction.

$$UCl_6 \rightarrow UCl_4 + Cl_2$$

The uranium tetrachloride formed then apparently reacts with other molecules of uranium hexachloride and the solvent to form the compound, $2UCl_4 \cdot UCl_6 \cdot 6POCl_3$. This compound, a dark green monoclinic crystalline material may be prepared by another, but very different technique from that just described. If a limited amount of water is added to a solution of (UCl_6^-) (PCl_4^+) in phosphorus oxychloride it is postulated that the following reaction occurs owing to liberation of the heat of hydration of the solvent:

$$2UCl_6^- \rightarrow UCl_4 + UCl_6 + 2Cl^-$$

The green compound then forms from the uranium chlorides and the solvent.

An intermediate in the reaction between hexachloropropene and uranium trioxide, previously unreported, was found to have the formula $5UCl_5 \cdot Cl_2C{=}CClCOCl$ (Trichloroacrylyl chloride). It is a dark red compound of low symmetry, but highly reactive.

Two solvates of uranium tetrachloride and phosphorus oxychloride, previously unreported, were found to have the formulae, $UCl_4 \cdot POCl_3$ and $UCl_4 \cdot 4POCl_3$. The blue monosolvate is formed from the green tetra-solvate by heating the latter in vacuo.

Evidence is presented that the dimeric uranium pentachloride, $(UCl_5)_2$ may actually exist in an ionic form, (UCl_6^-) (UCl_4^+).

Microfilm $2.00; Xerox $5.80. 116 pages.

A SPECTROSCOPIC STUDY OF THE FORMATION OF AMIDE-IODINE MOLECULAR ADDITION COMPOUNDS

(L. C. Card No. Mic 59-572)

Charles David Schmulbach, Ph.D.
University of Illinois, 1958

N,N-disubstituted amides react with iodine to form 1:1 molecular addition compounds. The existence of a 1:1 complex was established by a study of the infrared, ultraviolet and visible absorption spectra of solutions of amides and iodine in carbon tetrachloride. In the presence of a large excess of iodine a new carbonyl stretching band appears at lower wave numbers. The new band is attributed to a complexed amide species and indicates that bonding is through the carbonyl oxygen rather than nitrogen. Equilibrium constants were obtained for a series of 1:1 molecular addition compounds of amides and iodine. These amides were of the type $RCON(CH_3)_2$ where R- is H-, CH_3-, C_2H_5- and C_6H_5-. The equilibrium constant for diethyl acetamide is also reported. Thermodynamic constants are reported for the amide series. This represents the first detailed report on the measurement of thermodynamic constants of molecular addition compounds by infrared spectroscopy. The infrared method for determining equilibrium constants was found not to be generally applicable because of the relatively small change in the spectra of other carbonyl compounds in the presence of iodine.

A linear relationship between Taft's σ^* values and the shift in frequency ($\Delta\nu$) of the coordinated carbonyl stretching mole is observed except when R- is C_6H_5-. The same relationship holds for a plot of σ^* versus $-\Delta H$ (form). A plot of $\Delta\nu$ versus $-\Delta H$ (form) gives a linear plot for all amides of the series. An estimated $-\Delta H$ (form) may be obtained from this plot for any amide of similar geometry by measuring the $\Delta\nu$ at a single temperature.

A solid brown compound, possessing ionic character, is slowly formed in a carbon tetrachloride solution of the dimethyl acetamide (DMA) and iodine. On the basis of the analytical data the compound is assigned the formula of DMA:I_4.

The ultraviolet and visible spectrum of iodine in carbon tetrachloride is changed by the addition of amides. The exact position of the charge-transfer peak could not be obtained because of the considerable absorption of the carbon tetrachloride below 248 mμ. The absorption maximum of free iodine at 517 mμ is shifted to 454 mμ in the presence of dimethyl formamide and dimethyl acetamide.

At [DMA]:[I_2] mole ratios of 828:1 a new band appears at 367 mμ which is assigned to I_3^-. The intensity of the band at 367 mμ increases with time indicating a slow formation of an ionic species. The occurrence of the triiodide band in solutions where the dimethyl formamide (DMF):I_2 mole ratio is less than half that of a similar DMA:I_2 solution is unexpected.

The equilibrium constants and thermodynamic constants for DMA.I_2 and DMF.I_2 were measured by ultraviolet spectroscopy. The slightly lower values for K obtained by ultraviolet spectroscopy, as compared to those obtained by infrared spectroscopy, are explained in terms of the variation in activity coefficients of the amide. An inherent error in the method of determining the constants is given as an alternative cause for the low values. Larger heats of formation are obtained by ultraviolet spectroscopy. It is suggested that the observed heat of formation is the summation of a heat of complexation and a heat of solvation. The contribution of the heat of solvation to the overall heat of reaction under the conditions for ultraviolet absorption methods is larger than in the case of the infrared measurements. An alternative explanation is given in terms of the "Liquid Lattice Penetration Complex Theory."

Microfilm $2.00; Xerox $4.60. 89 pages.

CHEMISTRY, ORGANIC

BRIDGEHEAD CARBON STABILITY IN SOME 9-SUBSTITUTED-9,10-DIHYDRO-9,10-ETHANOANTHRACENES

(L. C. Card No. Mic 59-821)

Walter Roderick Benson, Ph.D.
University of Colorado, 1958

Supervisor: Associate Professor John S. Meek

This work is part of a study of 9-substituted-9,10-dihydro-9,10-ethanoanthracenes.

The first reported Beckmann rearrangement at a bridgehead position was carried out in this study with the oxime of 9-aceto-9,10-dihydro-9,10-ethanoanthracene. The product was 9-acetamido-9,10-dihydro-9,10-ethanoanthracene (I) and was identified by an independent synthesis.

9-Nitro-9,10-dihydro-9,10-ethanoanthracene was reduced chemically with lithium aluminum hydride and catalytically with Adams catalyst and hydrogen. The chemical reduction gave the higher yield of 9-amino-9,10-dihydro-9,10-ethanoanthracene (II) which on acetylation gave I. Another possible product was synthesized from the 9-chlorocarbonyl-9,10-dihydro-9,10-ethanoanthracene and methyl amine.

9-Benzoyl-9,10-dihydro-9,10-ethanoanthracene (VI) was synthesized by three different routes and found to be inert to oxime formation. This was surprising since the oxime of 9-benzoyl-9,10-dihydroanthracene is known. A steric explanation is offered. The oxime of VI was made by reaction of the magnesium salt of the imine of VI and hydroxylamine hydrochloride in a pyridine and alcohol solution. This oxime was rearranged with phosphorus pentachloride in a very short time compared with some other oximes. The product was 9-benzamido-9,10-dihydro-9,10-ethanoanthracene whose structure was proved by an independent synthesis. This product would not be expected according to Lyle and Lyle's (J. Org. Chem., 18, 1058 (1953)) rule. However, this product was expected if the mechanism were based on the long-tested rule of trans rearrangement for oximes. Hydrogen bromide gas in acetic acid gave a Beckmann rearrangement with the oxime of VI but with phenyl migration.

When the oxime rearrangement was run in dioxane at a higher temperature, an unidentified amide chloride was obtained indicating the importance of solvent in this reaction. Evidence indicated $C_{18}H_{16}NCl_2$ to be the formula.

Compound I was hydrolyzed to II in excellent yields with ortho-phosphoric acid while Bartlett and Cohen were unable to hydrolyze a similar ethanoanthracene.

Successful deaminations of II using hot nitrous acid in water and nitrosyl chloride in ether were carried out in a similar fashion to the substantiating work of Wilhelm and Curtin which produced 9-hydroxy-9,10-dihydro-9,10-ethanonathracene (III).

The Hofmann rearrangement was carried out on 9-carbamyl-9,10-dihydro-9,10-ethanoanthracene and gave a urethane which was more resistant toward hydrolysis than expected. However, II was finally obtained as an indication of a normal Hofmann rearrangement.

When the 9,10-dihydro-9,10-ethano-9-anthraldehyde was refluxed with base and methanol, a 95% yield of 9-methylol-9,10-dihydro-9,10-ethanoanthracene (IV) was obtained. The Cannizzaro reaction was expected but only 3% of the bridgehead carboxylic acid was found.

Compound IV when treated with thionyl chloride formed only the sulfite ester and further treatment did not yield the chloride. Aqueous hydrogen bromide and zinc bromide were not able to convert IV to the bromide. Zinc chloride and concentrated hydrochloric acid together with a small amount of acetic acid gave only the acetate of IV. Phosphorus tribromide in quinoline led to tar. Dry hydrogen bromide in boiling carbon tetrachloride or glacial acetic acid did not rearrange the alcohol IV.

9-Bromomethylanthracene and ethylene did not give the expected Diels-Alder reaction under the conditions used. Other routes are suggested for the synthesis of the bridgehead bromomethyl compound.

9,10-Dihydro-9,10-ethano-9-anthrylmethylcarbinol was prepared by two routes for proof of structure and refluxed with dry hydrogen bromide in solution to no avail. Acetyl chloride and acetic anhydride converted it to the acetate ester without rearrangement.

Acetyl chloride, acetic anhydride and phosphorus tribromide all converted 9,10-dihydro-9,10-ethano-9-anthryldimethylcarbinol to the same unsaturated hydrocarbon V. By ozonolysis V was converted to the bridgehead acetyl compound in high yield. Compound V was, therefore, 9-isopropenyl-9,10-dihydro-9,10-ethanoanthracene.

Attempts were made to nitrosate I under different conditions but no product could be isolated except starting material, although there was some slight evidence of a reaction.

Attempts to oxidize II with potassium permanganate and chromic acid were successful in destroying the molecule; with chromic acid, a stable chromate salt was formed which decomposed upon melting.

In order to improve the method for obtaining III from anthrone and ethylene, solvents and bases were varied with the result that pyridine was found to be the best solvent-base and to give the least amount of side reaction products.

When dianthrone was refluxed with anhydrous sodium acetate and acetic anhydride in the presence of air, a peroxide isomeric with anthraquinone was formed. 9,9'-Peroxy-9,9'-dianthracene-10,10'-dione is the proposed structure.

The infrared spectra of over thirty-five 9-substituted 9,10-dihydro-9,10-ethanoanthracenes were examined. All were found to have the characteristic shifted ortho disubstituted benzene peak from 754 to 760 cm^{-1}. However, all compounds gave very little of the characteristic aromatic peak usually found near 1600 cm^{-1} but the 1485 cm^{-1} peak was still present. These findings held for 9, 11, and 12 substituted compounds if no further strain was introduced.

From the reactions described in this thesis the system studied would seem stable but more reactions must be carried out to test this stability of the 9,10-dihydro-9,10-ethanonathracene system.

Microfilm $2.00; Xerox $6.00. 122 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

CONJUGATE ADDITION OF GRIGNARD REAGENTS WITH 1-NAPHTHYL TRIPHENYLMETHYL KETONE. A NOVEL DECARBONYLATION REACTION.

(L. C. Card No. Mic 59-474)

Kenneth Darrell Berlin, Ph.D.
University of Illinois, 1958

It has been shown that 1-naphthyl triphenylmethyl ketone undergoes conjugate addition when treated with Grignard reagents. The preparation of this ketone had been reported only once and in an unspecified yield. Thus a procedure was developed from which the compound can be prepared in a consistent manner.

The adducts obtained from the reactions of the benzyl and t-butyl Grignard reagents did not lend themselves well to study, but evidence was accumulated in support of the postulation that the compounds are the result of conjugate addition. The phenyl, o-tolyl, and p-tolyl reagents reacted smoothly, however, to give the 1,4-addition compounds in yields of 93.0, 24.6, and 40.8 per cent, respectively. Forcing conditions were required in all of the condensation reactions, and a ten-molar excess of the Grignard reagents was found to give the best yields of the adducts. Although chromatography gave products of higher purity, it was possible to crystallize the aryl adducts from the decomposed reaction mixtures. It was discovered that the reactions, including the decomposition stage, had to be performed under nitrogen. In fact, the highest yields were obtained when the heterogeneous, decomposition mixtures were heated under reflux for a period of eighteen hours or more. When the condensation involving the phenyl reagent was attempted in the presence of air, a tarry mass was obtained. Triphenylmethane was leached from the tar-like material; thus the intermediate enol may be sensitive to oxidation by air.

The phenylated compound survived treatment with chloranil, but when it was heated with palladium-on-charcoal, a novel cleavage occurred to produce triphenylmethane, 2-phenylnaphthalene, and carbon monoxide. The same type of reaction took place when the phenyl, o-tolyl, and p-tolyl adducts were pyrolyzed in the absence of catalysts. The presence of carbon monoxide formed in pyrolysis reactions, was detected by allowing the gas to bubble into a solution of palladium chloride which was reduced to black palladium.

The products obtained from each of the pyrolysis reactions were formed in high yields, a fact which supports the idea that the aryl adducts are dihydro in character. The aromatic analogues could not give triphenylmethane and the corresponding β-aryl naphthalene in yields which exceeded 50 per cent.

2-Phenyl- and 2-o-tolylnaphthalene had been reported in the literature and were easily identified, but 2-p-tolylnaphthalene apparently was unknown. This hydrocarbon was synthesized by an alternative route involving four steps; the over-all yield was 20 per cent. The reaction scheme entailed the preparation of the lithium compound from 1-bromonaphthalene; the lithium reagent was condensed with p-methylcyclohexanone. The product of this reaction was dehydrated by the use of fused potassium hydrogen sulfate. The crude dehydrated compound was aromatized by heating with palladium-on-charcoal to give 2-p-tolylnaphthalene.

Although starting material was obtained when 1-naphthyl triphenylmethyl ketone was treated with the methyl Grignard reagent in a benzene-ether solvent system, a cleavage occurred when more drastic conditions were employed. When anisole was the solvent and a fifteen-molar excess of the Grignard reagent was used, the ketone reacted to produce triphenylmethane, a hydrocarbon, a new ketone, and an alcohol. The possible structures for these compounds are discussed in the thesis.

Microfilm $2.00; Xerox $5.00. 99 pages.

THE PREPARATION AND CHARACTERIZATION OF 2,3-DIMETHYL-2,3-DIPHENYLCYCLOPROPANONE

(L. C. Card No. Mic 58-5124)

James Franklin Cogdell, Jr., Ph.D.
Emory University, 1950

Attempts to synthesize the cyclopropanone ring have been of interest to organic chemists because of the highly strained nature of the ring. This laboratory is investigating the synthesis of tetra-substituted cyclopropanones containing various combinations of alkyl and aryl groups. Here reported is the synthesis of such a ring containing two alkyl and two aryl groups, 2,3-dimethyl-2,3-diphenylcyclopropanone. The ring was closed by the dehalogenation of 2,4-dibromo-2,4-diphenylpentanone-3.

The first step in the problem was the preparation of 2,4-diphenylpentanone-3. The preparation of this ketone has not been previously recorded and several methods of synthesis were investigated. Two of the methods which gave satisfactory results will be described. The first of these methods was the acidic cleavage of methyl-α-methyl-α,γ-diphenyl-β-keto-valerate. This β-keto ester was prepared by the action of potassium amide on methyl-α-phenylpropionate in liquid ammonia and subsequent acylation of the product with α-phenylpropionyl chloride. The α-phenylpropionic acid was prepared in 40 per cent yields by the carbonation of the Grignard reagent derived from α-bromoethylbenzene. Cleavage of methyl-α-methyl-α,γ-diphenyl-β-keto-valerate with hydriodic acid and glacial acetic acid gave 2,4-diphenylpentanone-3 in 30 per cent yields. The 2,4-dinitrophenylhydrazone of this ketone was prepared and melted at 229°-230°.

The second method involved the preparation of α-phenylpropionitrile. This compound was prepared by treating phenylacetonitrile with sodium amide in liquid ammonia to yield the sodium salt. This sodium salt was alkylated with methyl iodide to yield α-phenylpropionitrile. α-Phenylpropionitrile was allowed to react with the Grignard reagent derived from α-bromoethylbenzene to yield a ketimine which, upon hydrolysis, produced 2,4-diphenylpentanone-3 in 55 per cent yields. This method was used for the preparation of the 2,4-diphenylpentanone-3 used in subsequent reactions.

Analysis of 2,4-diphenylpentanone-3 is as follows:

$C_{17}H_{18}O$	Calc. for C:	85.67%	Calc. for H:	7.61%
	Found:	85.49%	Found:	7.48%

Molecular weight, cryoscopic in benzene:

Calc: 238.31 Found: 231

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The 2,4-dinitrophenylhydrazone was prepared and found to melt at 228.5°-230°. Various mixtures of this hydrazone and that obtained from the ketone prepared by the cleavage of the β-keto ester all melted at 229°-230°, indicating that the 2,4-dinitrophenylhydrazones of the compounds made by two different methods were identical.

2,4-Diphenylpentanone-3 was brominated by a carbon tetrachloride solution of bromine to yield 2,4-dibromo-2,4-diphenylpentanone-3. This compound was unstable to heat and decomposed during ordinary distillation. Several samples were purified by molecular distillation. Analysis of the purified product gave the following results:

$C_{17}H_{16}OBr_2$	Calc. for Br:	40.35%
	Found:	39.97%

In order to effect cyclization of the ketone, a solution of the 2,4-dibromo-2,4-diphenylpentanone-3 in anhydrous ether was dehalogenated by shaking with finely divided, so called, molecular silver. The course of the reaction was followed by analyzing the solution for ether-soluble bromine compounds at various time intervals. The mixture were shaken an average of 160 hours. Apparently because of the contamination of the surface of the silver, it was necessary to add fresh silver during the reaction, usually after 60 hours and again after 90 hours. A run using 17 g. of 2,4-dibromo-2,4-diphenylpentanone-3 required approximately 90 g. of molecular silver and reached 92 per cent of completion at the end of 160 hours.

Dehalogenation and cyclization of 2,4-dibromo-2,4-diphenylpentanone-3 was also effected by the use of metallic mercury with vigorous mechanical stirring. Using mercury a fresh surface is continuously provided and the reaction was usually 96 per cent completed in 24 hours. In the subsequent reactions the 2,3-dimethyl-2,3-diphenylcyclopropanone was prepared by dehalogenation and cyclization of 2,4-dibromo-2,4-diphenylpentanone-3 using mercury. To minimize decomposition of the strained ring, the 2,3-dimethyl-2,3-diphenylcyclopropanone was purified by molecular distillation.

The analysis of the 2,3-dimethyl-2,3-diphenylcyclopropanone was as follows:

$C_{17}H_{16}O$	Calc. for C:	86.44%	Calc. for H:	6.82%
	Found for C:	86.51%	Found for H:	7.10%

Molecular weight, cryoscopic in benzene:

Calc: 236.1	Found: 248.5

In order to prove the structure of the 2,3-dimethyl-2,3-diphenylcyclopropanone thus prepared, it was necessary to transform it, by a sequence of standard reactions, to another compound whose structure could be proven. It was decided to convert the 2,3-dimethyl-2,3-diphenylcyclopropanone to 2,3-dimethyl-2,3-diphenylcyclopropanecarboxylic acid. The reaction used to effect this transformation were as follows:

2,3-Dimethyl-2,3-diphenylcyclopropanone was reduced to 2,3-dimethyl-2,3-diphenylcyclopropanol by the action of lithium aluminum hydride in anhydrous ether at 0°C. The benzoyl ester of 2,3-dimethyl-2,3-diphenylcyclopropanol was prepared by the action of benzoyl chloride.

The saponification equivalent of the benzoyl ester was found to be as follows:

$C_{24}H_{22}O_2$	Calc.:	342.42
	Found:	320.5

2,3-Dimethyl-2,3-diphenylcyclopropyl chloride was prepared by the action of dry hydrogen chloride on an ethereal solution of 2,3-dimethyl-2,3-diphenylcyclopropanol. A Grignard reagent was prepared from 2,3-dimethyl-2,3-diphenylcyclopropyl chloride and carbonated with solid carbon dioxide to yield 2,3-dimethyl-2,3-diphenylcyclopropanecarboxylic acid. The p-bromophenacyl ester of this acid was prepared and found to melt at 92°-93°. Bromine analysis of this ester was as follows:

$C_{26}H_{23}O_3Br$	Calc. for Br:	17.24%
	Found for Br:	17.55%

In order to prove the existence of the three-membered ring, 2,3-dimethyl-2,3-diphenylcyclopropanecarboxylic acid was also prepared by a different reaction which is known to produce a three-membered ring. The addition of ethyl diazoacetate to an olefin has been shown to produce a cyclopropanecarboxylic ester, and this reaction was used to prepare 2,3-dimethyl-2,3-diphenylcyclopropanecarboxylic acid.

Ethyl diazoacetate was added to cis-α,α'-dimethylstilbene to produce a ten per cent yield of crude ethyl ester of 2,3-dimethyl-2,3-diphenylcyclopropanecarboxylic acid. The ester was hydrolyzed to the free acid by sodium hydroxide solution. The p-bromophenacyl ester was prepared and found to melt at 90°-92°. The analysis of this ester was as follows:

$C_{26}H_{23}O_3Br$	Calc. for Br:	17.24%
	Found for Br:	17.10%

Various mixtures of the p-bromophenacyl esters from the two series of reactions melted at 91°-93° showing no depression and indicating that the acids from which they were derived were identical. In turn this also provides evidence of the successful preparation of 2,3-dimethyl-2,3-diphenylcyclopropanone.

Microfilm $2.00; Xerox $4.40. 82 pages.

A STUDY OF CITRAL AND RELATED COMPOUNDS

(L. C. Card No. Mic 58-5127)

Edward Royals Covington, Ph.D.
Emory University, 1954

Citral, an α,β-unsaturated aldehyde of the empirical formula $C_{10}H_{16}O$, occurs in natural lemon oil and is widely used in synthetic flavors and as an adjunct in perfumes. It is known that citral is cyclized and the α,β-double bond of "dihydrocitral" (3,7-dimethyl-Δ^2-octenal) undergoes hydration in an acidic aqueous medium. These reactions are evidently the causes of flavor changes which occur in lemon oil in contact with an acidic aqueous medium. Although the initial products resulting from the cyclization have not been identified, distillation of such a material is known to give p-cymene and a citral dimer.

Since it was of interest to determine whether p-cymene was one of the initial products, a spectrophotometric study was made which it was hoped would establish its presence. Citral, reacted with aqueous phosphoric acid for varied periods of time, showed an increase in transmission with time, when measured in the ultraviolet region. Although

this indicated that citral was undergoing change, no conclusion could be reached as to the presence of p-cymene because of absorption by unreacted citral after three weeks.

The portion of the molecular structure of citral which is responsible for its characteristic odor has never been established, and a few compounds possess such a fine lemon-like odor. The purpose of this work was to investigate compounds structurally similar to citral in order to gain such knowledge and to prepare, if possible, a more stable substitute for citral.

The methods of preparation of some of the starting materials and final products are new applications of known reactions and have led to new knowledge.

Known methods were used to prepare d-dihydrocitronellal and a mixture of 2,6-dimethyl-Δ^2-7-heptenal and 2,6-dimethyl-Δ^1-7-heptenal in order to compare their odors to citral. The former is similar to d-citronellal and the latter possesses an odor similar to plums.

Previously reported methods were examined for the preparation of geranic acid from ethyl β-hydroxydihydrogeranate and from geranonitrile. Ethyl β-hydroxydihydrogeranate was not dehydrated by the action of potassium acid sulfate and the fact that β-hydroxydihydrogeranic acid was decarboxylated as well as dehydrated by acetic anhydride and sodium acetate was confirmed. The α,β-double bond of geranonitrile was cleaved under alkaline conditions and gave a low yield of geranic acid as reported in the literature. Citral oxime was prepared in 70% yield and converted to geranonitrile in 80% yield by known methods.

Attempts to prepare 1-methylgeraniol by the addition of methylmagnesium iodide to citral gave only 2,6-dimethyl-$\Delta^{2,6,8}$-nonatriene.

An attempt to prepare 4,8-dimethyl-$\Delta^{3,7}$-nonadien-2-one by the addition of methylmagnesium iodide to geranonitrile showed that addition did not take place in refluxing ether.

Dibromoacetaldehyde dimethyl acetal was obtained in 15-20% yield by the bromination of bromoacetaldehyde dimethyl acetal.

A mixture of 2,3,6-trimethyl-Δ^2-heptenal and 3-ethyl-6-methyl-Δ^2-heptenal was obtained by the addition of iso-amylmagnesium bromide to a mixture of 2-methyl-3-ketobutanal dimethyl acetal.

The reduction of ethyl β-methylcinnamate with lithium aluminum hydride gave β-methylcinnamyl alcobol in 72% yield. The physical properties observed for this compound differ from those previously reported in the literature, but are believed to be accurate.

β-Methylcinnamyl alcohol was oxidized to β-methylcinnaldehyde by the action of manganese dioxide in an inert solvent. Resinification of the product during distillation reduced the yield to 24%. The odor of this compound is similar to that of cinnamaldehyde.

In addition to "dihydrocitral," the next lower homologous aldehyde, 3,7-dimethyl-Δ^2-heptenal possesses a lemon-like odor. Thus, it is evident that α,β-unsaturated aldehydes of seven to eight carbon chain length are most likely to possess such an odor. Whether the α,β-double bond must be included within the longest chain length should be shown by α-amylcrotonaldehyde. A new synthesis of this compound also led to knowledge of the orientation during condensations of unsymmetrical ketones with methyl formate. Methyl hexyl ketone was condensed with methyl formate in the presence of sodium methoxide. The sodium salt of hydroxymethylene methyl hexyl ketone was treated with methanolic hydrogen chloride to give a mixture of 3-ketononanal dimethyl acetal, 2-amyl-3-ketobutanal dimethyl acetal and the methyl enol ethers of the corresponding β-ketoaldehydes. One-half mole excess hydrogen chloride gave predominantly the methyl enol ether, while one-quarter mole and one-tenth mole excess gave an approximately equal distribution.

Reduction of the mixture with lithium aluminum hydride followed by hydrolysis and dehydration gave a mixture of α-amylcrotonaldehyde and α-nonenaldehyde. This showed that the condensation occurred in part on the methyl carbon and in part on the methylene carbon. Hydrogenation of the aldehydes gave 2-ethylheptanol and n-nonanol, respectively.

A synthesis of α-ethylheptanoic acid and its reduction by lithium aluminum hydride to 2-ethylheptanol is described. This also constitutes a structure proof of α-amylcrotonaldehyde.

A mixture of 1-methyl-3-ketopentanal dimethyl acetal and the methyl ether of the corresponding aldehyde, upon reduction with lithium aluminum hydride, hydrolysis and dehydration, was converted to 1-methyl-2-ethylacrolein.

Microfilm $2.00; Xerox $6.60. 139 pages.

THE RATE OF OXIME FORMATION OF THE ISOMERIC KETONES DERIVED FROM p-CYMENE AND OF OTHER ALKYL ARYL KETONES

(L. C. Card No. Mic 58-5128)

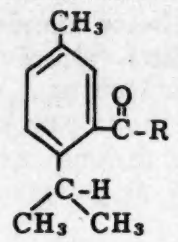
Mary Jean Craft, Ph.D.
Emory University, 1950

The determination of the rate of oxime formation of alkyl aryl ketones has been accomplished in an essentially irreversible manner. The medium used in this kinetic study was two molar pyridine in anhydrous methanol. Pyridine hydrochloride in conjunction with the large excess of pyridine served the dual purpose of an acid catalyst and adequate buffer system. In most cases the rates of oximation were determined at three temperatures. Duplicate determinations were made in each case and the rate constant k in liter mole^{-1} seconds^{-1} was calculated by the method of least squares.

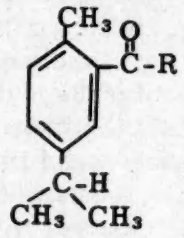
The course of the reaction was followed by the iodimetric determination of unreacted hydroxylamine at various time intervals. Since hydroxylamine and iodine do not react in stoichiometric quantities it was necessary to prepare a "standard reaction curve." A series of solutions corresponding to each ten per cent of the reaction was prepared. Aliquots from each were treated with a definite volume of iodine solution and after a definite period of time the solutions were back titrated with thiosulfate. The milliliters of thiosulfate necessary for the back titration were plotted against the per cent reaction. The aliquot portions withdrawn for analysis during the oximation studies were treated in exactly the same manner.

The main purpose of this problem was to determine the effect of ortho alkyl substituents on the reactivity of alkyl aryl ketones. The rates of oximation of twenty alkyl aryl ketones were determined in the anhydrous medium. The chief interest lay in the relative reactivity of the isomeric

ketones derived from p-cymene, the n-alkyl 3-methyl-6-isopropylphenyl ketones (I, R = methyl through heptyl) referred to as the alkyl thymyl ketones and the n-alkyl 2-methyl-5-isopropylphenyl ketones (II, R = methyl through heptyl) referred to as the alkyl carvacryl ketones. The alkyl thymyl ketones are of particular interest in that their

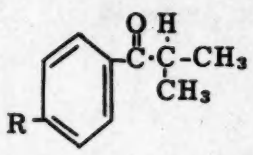


I

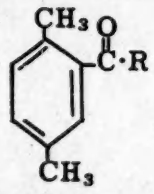


II

preparation has not been previously reported and in that no aromatic ketones containing an isopropyl group ortho to the carbonyl function have been previously studied. The other ketones studied in the anhydrous medium were four p-alkyl isopropiophenones (III, R = methyl, ethyl, isopropyl and t-butyl) and two p-xylyl ketones (IV, R = isopropyl and



III



IV

sec.-butyl). The rates of oximation in anhydrous methanol are tabulated in Table I.

TABLE I

RATES OF OXIME FORMATION OF ALKYL ARYL KETONES IN ANHYDROUS METHANOL

Ketone	k X 10^4 liter $mole^{-1}$ $sec.^{-1}$ 30°	35°	40°
Methyl Thymyl	10.27	12.35	16.46
Ethyl Thymyl	2.32	2.86	3.66
Propyl Thymyl	1.72	2.43	3.44
Butyl Thymyl	2.00	2.18	3.55
Amyl Thymyl	1.59	2.40	2.92
Hexyl Thymyl	1.47	1.92	2.29
Heptyl Thymyl	1.72	2.20	2.87
Methyl Carvacryl	18.32	27.40	32.71
Ethyl Carvacryl	5.75	7.90	10.24
Propyl Carvacryl	5.07		8.91
Butyl Carvacryl	4.83	6.81	8.89
Amyl Carvacryl	4.93	6.35	8.55
Hexyl Carvacryl	4.69	6.78	8.60
Heptyl Carvacryl	4.56	5.80	7.81
p-Methyl Isopropiophenone	17.9		32.1
p-Ethyl Isopropiophenone	17.4		30.6
p-Isopropyl Isopropiophenone	15.1		26.6
p-t-Butyl Isopropiophenone	18.1		35.8
Isopropyl p-Xylyl Ketone	1.87		3.09
sec.-Butyl p-Xylyl Ketone	0.48		

In conjunction with this work, similar studies were carried out by other workers in this laboratory on the n-alkyl p-xylyl and phenyl ketones. The relative order of reactivity of the methyl, ethyl, propyl and butyl ketones of the thymyl, carvacryl, p-xylyl and phenyl series at thirty degrees is given in Table II.

TABLE II

RELATIVE ORDER OF OXIMATION OF ALKYL ARYL KETONES IN ANHYDROUS METHANOL AT 30° C.

Series	Methyl Ketones	Ethyl Ketones	Propyl Ketones	Butyl Ketones
Thymyl	1.00	1.00	1.00	1.00
Carvacryl	1.78	2.40	2.95	2.42
p-Xylyl	1.79	3.72	3.37	2.61
Phenyl	23.95	62.5	61.7	58.5

The data in Table II is indicative of the depressing action of alkyl substituents on the reactivity of alkyl aryl ketones. It is interesting to note that the rates of the methyl thymyl and the methyl phenyl ketones differ by a factor of twenty-four but that the difference in the next three members of these two series levels off to a factor of approximately sixty. The difference in reactivity of the isomeric thymyl and carvacryl ketones is attributed chiefly to steric effects, the inductive effects of the o-methyl and o-isopropyl substituents being essentially the same. The greater steric effect exerted by the isopropyl group arises from the fact that it forces the carbonyl group out of the plane of the benzene ring to a greater extent than does the less bulky o-methyl group.

In order to determine the effect of the solvent on the reaction velocity and on the relative order of reactivity similar studies were carried out in seventy-five per cent ethanol. The buffer system, pyridine-pyridine hydrochloride, and its initial concentration and the method of following the course of the reaction were the same as in the anhydrous determinations. Two or three ketones each from the thymyl, carvacryl, p-xylyl and phenyl series were studied in the semi-aqueous medium. Although no special attempt was made to achieve irreversibility as in the

TABLE III

RATE OF OXIME FORMATION OF ALKYL ARYL KETONES IN SEVENTY-FIVE PER CENT ETHANOL

Ketone	k X 10^4 liter $mole^{-1}$ $sec.^{-1}$ 30°	40°
Methyl Thymyl	5.05	9.51
Ethyl Thymyl	1.38	2.44
Propyl Thymyl	0.96	1.74
Propyl Carvacryl	2.67	5.05
Butyl Carvacryl	2.52	4.22
Methyl p-Xylyl	13.57	24.11
Ethyl p-Xylyl	5.00	9.94
Propyl p-Xylyl	3.32	6.27
Ethyl Phenyl	86.2	144.5
Propyl Phenyl	62.8	117.1

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anhydrous medium the reaction in seventy-five per cent ethanol was found to go to essentially one hundred per cent completion. The rates of oximation were determined at two temperatures and duplicate determinations were made at each temperature. The k values calculated by the method of least squares are tabulated in Table III.

The rate constants obtained from the reaction in the semi-aqueous medium were compared with those obtained from the anhydrous medium and the ratios are tabulated in Table IV.

TABLE IV

RATIO OF RATES OF OXIMATION IN SEVENTY-FIVE PER CENT ETHANOL AND IN ANHYDROUS METHANOL

Ketone	k (Semi-aqueous) / k (Anhydrous) 30°	40°
Methyl Thymyl	0.49	0.58
Ethyl Thymyl	0.59	0.67
Propyl Thymyl	0.56	0.51
Propyl Carvacryl	0.53	0.57
Butyl Carvacryl	0.52	0.47
Methyl p-Xylyl	0.74	0.60
Ethyl p-Xylyl	0.58	0.61
Propyl p-Xylyl	0.57	0.52
Ethyl Phenyl	0.59	0.48
Propyl Phenyl	0.59	0.54

It was observed that the rate of oximation in the anhydrous medium is greater than that in the aqueous medium by a factor of almost two. The difference is attributed to differences in solvent basicity, i.e., the escaping tendencies of the catalyzing acid from anhydrous methanol are greater than those from the more basic aqueous ethanol solvent and the catalytic coefficients are in the same order.

The ratio of the rates in the semi-aqueous solvent to those in the anhydrous solvent has a mean value of 0.57. The average deviation from the mean is 4.6 per cent. With few exceptions the order of reactivity in the two solvents is the same in both a qualitative and quantitative manner. This is highly indicative that reactivities governed primarily by steric and secondarily by inductive effects are not subject to change in order of reactivity with a change in solvent.

B. SYNTHESIS OF THE ALKYL THYMYL KETONES

All of the ketones studied in this work were prepared in this laboratory. This problem was concerned with the synthesis of the alkyl thymyl ketones, the preparation of which have not been previously reported. Attempts to prepare these ketones by the addition of 3-methyl-6-isopropylphenylmagnesium bromide to a large excess of the appropriate acid chlorides resulted in a series of mixtures containing a very small amount of the desired ketones. Although the reaction mixtures were apparently excluded from atmospheric oxygen by the use of pyrogallol traps, it was found that the Grignard reagent underwent oxidation in some manner to the bromomagnesium thymolate salt. The thymol salt reacted with the acid chlorides to form a series of thymol esters, the boiling points of which are very similar to the corresponding ketones.

The second method employed for the preparation of the alkyl thymyl ketones involved the interaction of 3-methyl-6-isopropylbenzoyl chloride with an ethereal solution of the appropriate dialkyl cadmium compound

$$2\ ArCOCl + R_2Cd \longrightarrow 2\ ArCOR + CdCl_2$$

The yield, based on the amount of acid chloride used, ranged from forty-nine to sixty-eight per cent. However, if based on the amount of starting material, thymol, the overall yield is less than three per cent.

Aside from the problem of obtaining the necessary starting materials, the only difficulty encountered in these syntheses was the formation of forty-five per cent ethyl 3-methyl-6-isopropylbenzoate during the synthesis of the propyl thymyl ketone. This side reaction was due to the cleavage of diethyl ether by the acid chloride in the presence of magnesium salts.

$$ArCOCl + (C_2H_5)_2O + MgCl_2 \longrightarrow ArCOOC_2H_5 + C_2H_5Cl$$

The ester was removed by saponification of the ketone-ester mixture. Microfilm $2.10; Xerox $7.40. 157 pages.

A STUDY OF THE REDUCTION OF CERTAIN 1-SUBSTITUTED NAPHTHALENES BY ALKALI METALS IN LIQUID AMMONIA

(L. C. Card No. Mic 59-1473)

Gerald Titus Davis, Ph.D.
The University of Tennessee, 1958

Major Professor: Jerome F. Eastham

The reduction of 1-aminonaphthalene with potassium and ammonium chloride or ethanol was found to give the 5,8-dihydro derivative. 1-Methyl and 1-dimethylaminonaphthalene gave the corresponding 5,8-dihydro compounds when reduced with potassium and ammonium chloride, but when 1-dimethylaminonaphthalene was reduced with potassium and tert.-amyl alcohol the reduction product was the 5,6,7,8-tetra hydro derivative.

The base catalyzed isomerization of the 5,8-dihydro derivatives of 1-amino, 1-methylamino and 1-dimethylaminonaphthalene formed the corresponding 7,8-dihydro derivatives as the major products. The effectiveness of strong base on this isomerization was found to be in decreasing order: amoxide, isopropoxide and ethoxide.

Two lines of evidence were adduced to support the electron addition mechanism for the reduction of carbon-carbon unsaturation by alkali metal-acid systems in liquid ammonia. First, competitive reduction showed that the reduction is hindered by the presence of electron-releasing groups, and that it is facilitated by the presence of electron-attracting groups. Second, it was shown that the reduction of a substrate by metal-acid systems occurs much faster than the reaction of the metal and acid to liberate hydrogen.

In addition, evidence was found to indicate that the addition of a proton to the reduction intermediate may also be slow. These facts were taken as evidence that the reduction occurs by the slow reversible addition of electrons and slow irreversible addition of protons.

Certain striking differences were found in the reaction rates of various combinations of acids and metals in causing reduction.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

As a corollary of the above work, a number of organic compounds were synthesized. The following compounds which have not been previously reported were prepared and characterized during the course of this work.

1-Iodo-7,8-dihydronaphthalene
7,8-Dihydro-1-naphthoic acid
1-Dimethylamino-7-methoxynaphthalene
Picrate of 1-dimethylamino-7-methoxynaphthalene
1-Formamido-5,8-dihydronaphthalene
1-Methylamino-5,8-dihydronaphthalene
N-Benzenesulfonyl-1-methylamino-5,8-dihydronaphthalene
N,N-Bisbenzenesulfonyl-1-amino-5,6,7,8-tetrahydronaphthalene
1-Formamido-5,6,7,8-tetrahydronaphthalene
1-Methylamino-7,8-dihydronaphthalene
N-Benzenesulfonyl-1-methylamino-7,8-dihydronaphthalene
1-Dimethylamino-5,8-dihydronaphthalene
Picrate of 1-dimethylamino-5,8-dihydronaphthalene
1-Dimethylamino-7,8-dihydronaphthalene
Picrate of 1-dimethylamino-7,8-dihydronaphthalene.

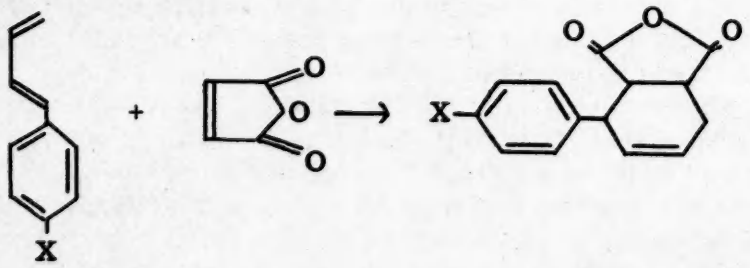
Microfilm $2.00; Xerox $6.00. 125 pages.

THE DIELS-ALDER REACTION: MECHANISM AND RATE STUDIES

(L. C. Card No. Mic 58-5133)

Elmer John DeWitt, Ph.D.
Emory University, 1955

For the first time a quantitative procedure has been applied to competitive rate studies of the Diels-Alder reaction. The reaction chosen for study was the addition of 1-para-substituted-phenylbutadienes, I, to maleic anhydride, II, in dioxane at 25, 35, and 45 degrees to produce adducts, III.



I II III

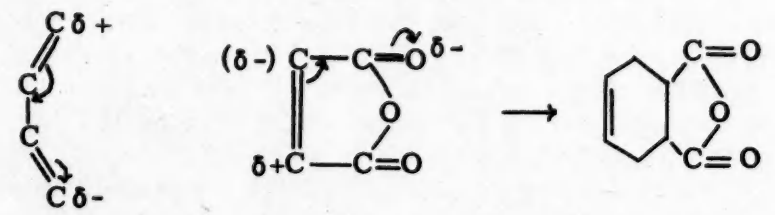
X - MeO, Me, H, Cl, and NO_2

The groups located in the para position of the benzene ring included both electron attracting and electron repelling groups, namely, methoxyl, methyl, hydrogen, chloro, and nitro.

Evidence for both a free radical and an ionic type mechanism has been published in the literature from time to time. Evidence for the free radical mechanism has usually been derived from reactions carried out in the gaseous phase and has been based on entropy calculations or orientation effects. Evidence for an ionic mechanism has been derived from reactions carried out in the gaseous, but usually liquid, phase and has been based on orientation effects and electrical effects on rates. In nearly every instance the major product obtained from the addition of unsymmetrical dienes and dienophiles carried out in the solution phase could be predicted, assuming an ionic type mechanism and considering electrical effects.

From an investigation of the reaction between cyclopentadiene and benzoquinone, it was shown that iodine, a free radical scavenger; and oxygen, peroxides, and cuprous chloride, free radical initiators, had no effect on the rate of reaction.

In this investigation it was found that the rate of addition of the 1-para-substituted-phenylbutadienes to maleic anhydride fell in the order shown when X was the group named: methoxyl > methyl > hydrogen > chloro > nitro. This is the order which would be predicted, assuming an ionic mechanism. Further evidence for the anionoid-cationoid mechanism was obtained when it was found that a plot of log k/k_0 values versus Hammett's sigma values produced a straight line in accordance with the Hammett equation. The point due to the methoxyl group, however, did not fall on the line. This is not surprising for the methoxyl group has been shown in many instances to deviate markedly from the best straight line. In fact, according to recent theory on electromeric effects in electrophilic type reactions, the methoxyl group is predicted to have a higher value than that given by Hammett. An English worker has assigned to it the value of -0.58 instead of -0.226. This work further confirms the value of -0.58 for the sigma value of the methoxyl group. This indicates, therefore that an electromeric effect operates under the influence of the attacking electrophilic maleic anhydride. This is further evidence for the anionoid-cationoid type of mechanism. The evidence from the present work points toward a mechanism proposed by some other investigators. In view of the stereochemical course of the reaction as reported in the literature by other workers, the concerted type of mechanism is preferred as follows:



The quantitative procedure used to determine competitive rates was an important part of this investigation and was an application of the isotopic dilution technique to radioactive compounds. Radioactive maleic anhydride-1-C^{14} was prepared from potassium cyanide-C^{14} and ethylene bromide and possessed a specific activity of 72.0 (90.4) microcuries per millimole.

A ten-fold excess of two different dienes was allowed to react simultaneously with the maleic anhydride. After enough time had elapsed for complete reaction the solution was divided in half, and each aliquot was diluted with a relatively large amount of inactive adduct of the same structure as that formed in the reaction, i.e., adduct IV was added to the first aliquot and adduct V was added to the second aliquot. These adducts were recrystallized to purity using hold back technique and purified further by sublimation. Although large losses were taken during purification, enough adduct was available to determine the specific activity; and thus it was possible to calculate quantitatively the actual yield of each adduct by the following equation.

$$A_0X = A_1 (D_1 + X)$$

A_0 represents the specific activity of the maleic anhydride or undiluted adduct, A_1 the specific activity of the diluted adduct, D_1 the amount of diluent added, and X the yield of adduct.

Because this was a pseudo-first order reaction, the ratio of yields is the same value as the ratio of the two rate constants. When the logarithm of these values were plotted against Hammett's sigma values, a straight line was obtained with the point due to the methoxyl group falling far above the line as expected from recent electromeric theory on electrophillic reactions. The value for the methoxyl group checked with the value recently proposed by an English worker.

The rate of addition of 1-phenyl-, 1-para-chlorophenyl-, and 1-para-tolyl-butadiene to maleic anhydride respectively was determined by a new method developed during this research.

It was discovered by a previous investigator, about 1940, that certain compounds gave a color reaction in chloroform or benzene with triphenyl phosphine. These compounds had the maleic anhydride and benzoquinone type structure in common. Maleic anhydride and benzoquinone developed the color rapidly at room temperature while some of the substituted analogs gave the color only in boiling chloroform. It was found, however, that when all positions of the maleic anhydride or benzoquinone nucleus were substituted no color developed. Exceptions to this were the chlorinated and brominated benzoquinone.

In the present work it was found that triphenyl phosphine in a chloroform solution would produce an immediate yellow color when it was added to a dioxane solution of maleic anhydride. The yellow color gradually darkened and absorbed light at 461 millicrons. Since maleic anhydride and the dienes used did not absorb at this wave length, a procedure was developed whereby the rate of disappearance of maleic anhydride could be followed. It was found that the rate of development of color depended on the concentration of both the maleic anhydride and triphenyl phosphine as well as on temperature. The nature of the diene present also had a catalytic effect, although its concentration was not critical.

Standard solutions were prepared containing the same ingredients as the kinetic solutions in almost the exact concentrations. From these solutions optical density readings were taken at definite time intervals and smooth standard curves were plotted, showing the rate of color development. From these curves it was possible to determine the concentration of maleic anhydride at various times in the kinetic solutions. Thus, when the logarithm of the concentration was plotted against time, smooth first order curves were obtained. The rates of the phenylbutadiene addition to maleic anhydride were determined at three different temperatures. On plotting the logarithm of the rate constant values versus the inverse of the absolute temperature, the activation energy was obtained and fell in the range of activation energies reported for other Diels-Alder reactions run under similar conditions.

Microfilm $2.00; Xerox $4.20. 78 pages.

PARACHORS OF HYDROCARBONS: OCTANES AND ALKYLBENZENES.

(L. C. Card No. Mic 58-5135)

Raymond Edwin Donaldson, Ph.D.
Emory University, 1950

The surface tensions of seventeen isomeric octanes, benzene and twenty alkylbenzenes have been measured and their parachors calculated. These compounds were made available by the American Petroleum Institute and the National Bureau of Standards through the API Research Project 44 on the "Collection, analysis, and calculation of data on hydrocarbons." The samples were purified at the National Bureau of Standards by the API Research Project 6 on the "Analysis, purification, and properties of hydrocarbons." These samples are all above 99.60 mole per cent pure and it is believed that, within an experimental error of 0.1 per cent, the parachors determined in this work are reliable. It is probable that they are more reliable than those reported previously by other workers using inferior samples.

The surface tensions were measured by the maximum bubble pressure method devised by Sugden. However, the system used for the measurements was revised according to the method developed by Quayle and Smart, which was reported in 1944. These measurements were made at three temperatures, 20, 30, and 40 degrees C. This information, together with that already published by the Bureau of Standards, was used to calculate the parachors of each of the compounds at the three temperatures by the formula $P = M\gamma^{1/4}/D-d$. These three parachors were averaged to give the average parachor for each of the compounds.

From the parachors of the isomeric octanes it was possible to arrive at certain conclusions. The value of 40.0 for a CH_2 group in a normal chain paraffin is taken as the normal value and any deviation from this value within a group is attributed to overlapping spheres of influence, or crowding of the atoms that compose the group, and therefore is characteristic for that particular arrangement of the atoms. Thus the parachor of a complex molecule may be calculated by adding the parachors of the particular groups of which it is composed, with the provision that a correction for the proximity of the groups to each other is also included.

The simpler members of the series of isomeric octanes were used to calculate the parachors of any new group which appeared. For instance, 2-methylheptane is composed of an isopropyl group joined to a normal straight chain of five carbon atoms. Since the parachors of the normal straight chain hydrocarbons show a constant value of 40.0 parachor units for each CH_2 and 15.5 for the end H, the parachor of the n-amyl part of this compound is 215.5. The value for an isopropyl group may then be found by subtracting this value for the n-amyl group from the parachor of 2-methylheptane. The value found in this manner for the isopropyl group is 133.3. In a similar manner the parachor of each other group appearing in the series was determined. Proximity corrections were also calculated, such as that for methyl groups on adjacent carbons. For use in subsequent calculations of the theoretical parachors of other compounds containing these groups, the determined group parachors were tabulated.

Our theory of the additivity of these constitutive group parachors seems to be substantiated by the agreements

found between the calculated and observed parachors of the members of this series. As an illustration, the calculated parachor of 2,5-dimethylhexane is the sum of two normal methylene groups (80.0) and two isopropyl groups (266.6), or 346.6. The observed parachor was 347.0. This is a deviation from the calculated parachor of 0.11 per cent. For eight members of the series of octanes the parachors were calculated from the group parachors and compared with those observed. Omitting 2-methyl,3-ethylpentane which shows a deviation of 1.0 per cent, the average deviation between calculated and observed values is 0.07 per cent. Without using such group values, the deviations between calculated and observed parachors vary to a much greater degree and have an average variation of 2.2 per cent.

From the parachors of the alkylbenzenes, certain corrections for the introduction of groups into the benzene nucleus and on an alkyl side chain, under varying conditions of existing substitution, were evaluated. The parachors of these compounds, reveal by their CH_2 increments that to calculate a correct theoretical parachor for an alkylbenzene it would be necessary to know the corrections for groups in various positions on the ring. Substitution, under any condition, of a methyl group at any position on the ring, or on an alkyl chain out to at least as far as the γ carbon atom, will give an increment somewhat less than the 40.0 which is the normal straight chain methylene increment. The recognition of this fact led to the tabulation of positional corrections for the substitution of groups in various positions.

In addition to the above compounds, a series consisting of p-xylene and eight alkyl p-xylenes was examined. This series provides a demonstration of the usefulness of the positional corrections, derived from the series of API-NBS alkylbenzenes, by showing the agreement between the calculated parachors and the ones observed. In the series of eight substituted p-xylenes the deviation of the calculated parachor from the observed value was below 0.2 per cent with one exception. The average deviation was 0.15 per cent.

Data for the densities, surface tensions, and parachors for these compounds are tabulated at 20, 30, and 40° C. The influence of temperature on the surface tensions of all of the compounds is shown by appropriate graphs that accompany each series.

This work lends support to the theory that if constitutive variations for individual groupings of atoms are determined, the parachors of complex molecules can be calculated in an additive manner with a minimum of error.

Microfilm $2.00; Xerox $4.20. 78 pages.

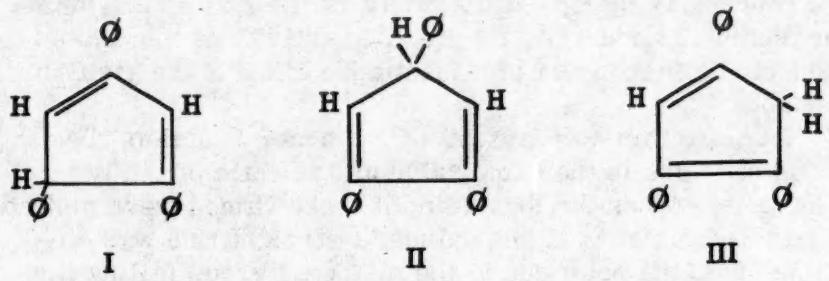
THE REACTIONS OF 1,2,4-TRIPHENYL-2,4-CYCLOPENTADIENE AND SOME OF ITS DERIVATIVES

(L. C. Card No. Mic 59-1262)

Mark Stanley Fawcett, Ph.D.
University of Minnesota, 1958

Adviser: Dr. C. F. Koelsch

Although 1,2,4-triphenyl-Δ-x,y-cyclopentadiene (m.p. 149°) has been known for sixty years (1), no work has ever been done to elucidate its structure. This compound can exist in three possible isomeric forms (I, II, III).



The object of this investigation was the study of the reactions and spectra of this compound and its methyl-substituted derivatives with the hope of determining which of the above is the correct structure for this compound.

New syntheses of 1,2,4-triphenyl-Δ-x,y-cyclopentadiene (m.p. 150-151°), 3-methyl-1,2,4-triphenyl-Δ-x,y-cyclopentadiene (IV, m.p. 161.5-162.5°) and 3,5-dimethyl-1,2,4-triphenyl-Δ-x,y-cyclopentadiene (V, m.p. 126.5-127°) by the addition of phenyl magnesium bromide to 3,4-diphenyl-, 2-methyl-3,4-diphenyl- and 2,5-dimethyl-3,4-diphenylcyclopenten-2-one-1 with subsequent spontaneous dehydration were carried out. In addition, a compound believed to be 3,4-dimethyl-1,2,4-triphenyl-2,5-cyclopentadiene (VI, m.p. 145-145.5°) was obtained by the addition of phenyl magnesium bromide to 5,5-dimethyl-3,4-diphenylcyclopenten-2-one-1. This reaction would be expected to yield 3,3-dimethyl-1,2,4-triphenyl-1,4-cyclopentadiene but the infrared spectrum was not consistent with this structure and a carbonium ion rearrangement was believed to have taken place to give the compound described.

The isomer of 1,2,4-triphenyl-Δ-x,y-cyclopentadiene obtained from the Grignard reaction had the same melting point as the isomer originally prepared although the two different methods of synthesis should have given two different isomers. Furthermore, in the case of IV and V, different syntheses also gave the same isomers respectively, as demonstrated by their melting points and spectra. A limited number of cases previously reported in the literature support the conclusion that only one isomer in a given polyphenyl-cyclopentadiene system appears to be stable enough to be isolated and the other possible isomers readily rearrange to this isomer.

Oxidative degradation of 1,2,4-triphenyl-Δ-x,y-cyclopentadiene with ozone and chromium trioxide proved unsuccessful. Condensation with benzaldehyde gave a fulvene, demonstrating the presence of an actual or potential methylene group. Treatment of the diene with sodium ethoxide or sodamide gave back the same isomer upon reacidification. Methylation of the sodium salt with methyl iodide gave IV.

The maleic anhydride adduct (VII) and the acrylonitrile adduct (VIII) of 1,2,4-triphenyl-Δ-x,y-cyclopentadiene were prepared as well as the maleic anhydride adducts of IV, V and VI.

Various attempts at degradation of VII gave anomalous products but oxidation of VIII with potassium permanganate in acetone yielded a dihydroxy compound which was cleaved by lead tetraacetate to a benzoyl-cyano-diphenyl-cyclopentane aldehyde (IX). This product could only have been obtained from the adducts of I or III, thus eliminating II as the structure for 1,2,4-triphenyl-Δ-x,y-cyclopentadiene. Hydrolysis of IX proved more complex than expected, giving products which apparently involved ring closures.

Analysis of the infrared and ultraviolet spectra of 1,2,4-triphenyl-Δ-x,y-cyclopentadiene and its methyl-substituted derivatives was severely handicapped by the lack of the spectra of model compounds and was therefore of little help except that an intensive study of the infrared spectrum of 1,2,4-triphenyl-Δ-x,y-cyclopentadiene obtained with a lithium fluoride prism gave no indication of the presence of a methylene group, thus eliminating structure III.

Consequently, I is believed to be the correct structure and the compound studied is believed to be 1,2,4-triphenyl-2,4-cyclopentadiene.

Reference

1. Wislicenus and Newmann, Ann., 302, 236 (1898).

Microfilm $2.00; Xerox $4.40. 82 pages.

THE ROLE OF THE MEDIUM IN THE RACEMIZATION OF A HINDERED BIPHENYL CATION

(L. C. Card No. Mic 58-5992)

William Hardin Graham, Ph.D.
The Florida State University, 1958

The racemization of optically active hindered biphenyls is an extremely simple reaction. The mechanism is known to a high degree of certainty; the differences between the ground state and transition state of the molecule are slight, the charge being the same in both states. Only small geometrical differences and large variations in the internal energy of rotations and vibrations distinguish the ground from the transition state. Any observed solvent or salt effect will probably result from one of these factors. This reaction thus offers a means of studying the very intimate solvation because the long range solvation forces will cancel out between the ground and transition states. Other reactions have this type of solvation in common with this system so that this is a means of estimating the magnitude of intimate solvation forces.

This investigation is part of a program which will include the kinetic study of solvent effects on biphenyl molecules of all charge types. Only the cationic biphenyl ion, d-o-(2-dimethylaminophenyl)phenyltrimethylammonium was studied here. Racemizations were conducted at two temperatures so that the enthalpy and entropy of activation could be calculated.

Rate studies were carried out in fifteen pure solvents and many solvent mixtures and salt solutions.

The results may be summarized as follows:

1. Organic solvents (except trifluoroethanol) increase the rate relative to water. The rate increase always is a result of a lower $\Delta H^{\ddagger}$ with a partially compensating $\Delta S^{\ddagger}$.

2. The $\Delta H^{\ddagger}$ vs. $\Delta S^{\ddagger}$ relationships for aqueous-organic mixtures generally have a break at some intermediate composition. Also there is sometimes observed a maximum or minimum in the racemization rate at some intermediate composition.

3. The addition of salts to water increased the rate constant by lowering $\Delta H^{\ddagger}$ and despite a more negative $\Delta S^{\ddagger}$. Large ions, especially ions which form micelles, had a much more pronounced effect. Large anions were more effective than large cations.

4. Addition of salts to aqueous organic mixtures produced effects similar to salts in water except that the size of the ion was unimportant.

5. There was no evidence of preferential solvation of the enantiomorphic ions by an optically active solvent, nor was there evidence for diastereoisomeric ion-pair formation.

The results are most readily interpreted if the differences in reaction rate constants are attributed mainly to differences in intimate ground state solvation. This implies that the higher energy vibrational and rotational levels of the transition state are less readily solvated.

Also it is concluded that the intimate solvation is more subject to small steric interference than ion association. This conclusion is supported by the fact that the rate of racemization is faster in those solvents where ion association takes place and especially in miceller solutions.

Microfilm $2.20; Xerox $7.80. 166 pages.

REACTIONS OF SUBSTITUTED 2-ARYLETHANOLS WITH RANEY NICKEL UNDER REDUCTIVE DESULFURATION CONDITIONS

(L. C. Card No. Mic 59-1438)

Thomas Wright Greenlee, Ph.D.
Stanford University, 1959

Supervisor: W. A. Bonner

Zderic found that when 2-phenyl-1,2-propanediol (4.00 g.) and Raney nickel catalyst (about 15 g.) were refluxed for six hours in ethanol (50 cc,), ethylbenzene was formed. Our repetition of this work established that the anticipated isopropylbenzene was also present in a lesser amount. Compounds structurally related to 2-phenyl-1,2-propanediol were synthesized and subjected to the same reaction (referred to as the "cleavage reaction") in order to determine the structural requirements for cleavage. The reaction products were isolated, separated by vapor-liquid partition chromatography, and were characterized by comparison of VLPC retention times and infrared spectra with those of authentic specimens.

The data from these experiments show that for carbon-carbon bond cleavage to occur to a significant extent, the following structural features must be present in the reactant molecule:



where R and R' may be alkyl or aryl substituents, or hydrogen; and Ar is an aromatic nucleus.

Similar carbon-carbon bond cleavage also occurred over hydrogen-free Raney nickel. No simple dehydroxylation product was found in this case.

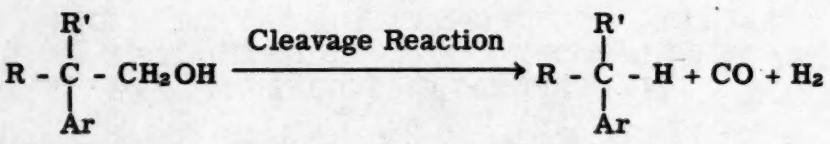
Both carbon-carbon bond cleavage and simple dehydroxylation were usually observed when compounds having the above structure were subjected to the cleavage reaction. Increased substitution at C_2 caused an increase in the relative amount of cleavage.

The effect of nuclear electron density on the relative amount of cleavage was investigated by subjecting para

substituted 2-phenylethanols to the cleavage reaction. An electron-introducing group (p-amino) gave rise to almost exclusive formation of cleavage products accompanied by some nuclear reduction. An electron-withdrawing group (p-(methyl carboxylate)) increased the relative amount of cleavage somewhat. When 2-(p-anisyl)ethanol was subjected to cleavage conditions little reaction occurred.

When 2-phenyl-1,2-propanediol-1-C^{14} was subjected to the cleavage reaction the ethylbenzene recovered was found to be without radioactivity. Hence only C_1 is removed by the cleavage. Similar behavior is assumed for other substituted 2-arylethanol substrates.

When 2-phenyl-1,2-propanediol-1-C^{14} was subjected to cleavage in a system where the evolved gas could be collected, it was found that 75% of the original label remained associated with the catalyst. The filtered reaction medium contained 19% of the label and the gases evolved during the reaction contained only 0.4%. Acid decomposition of the cleavage catalyst showed carbon monoxide to be the predominant single carbon compound associated with it. Hence the stoichiometry of the cleavage reaction appears to be:



Ethanol was also found to cleave slowly to methane and carbon monoxide under similar conditions.

The cleavage of optically active (-)-2-methyl-2-phenyl-1-butanol to (+)-s-butylbenzene appeared to proceed with inversion of configuration. The (+)-s-butylbenzene product was found to be 66% optically pure.

Optically pure (+)-s-butylbenzene was synthesized and subjected to the environmental conditions of the cleavage reaction, with the observation that it racemized slowly under cleavage conditions. When racemization was carried out over deuterized Raney nickel in deuteroethanol, the rate of deuterium uptake was much greater than the racemization rate. Each of the aliquots withdrawn at two hour intervals contained a complex mixture of polydeuterated s-butylbenzene isomers. It is apparent that hydrogen-deuterium exchange in (+)-s-butylbenzene occurs partially stereospecifically with configurational retention.

The Raney nickel catalyst (W-2) used in these investigations was prepared by Zderic's modification of Mozingo's method. All samples were stored at room temperature and all were used within three months of preparation.

Microfilm $2.00; Xerox $7.20. 151 pages.

PART I. THE SPECIFIC HYDROLYSIS OF CERTAIN AMIDES INVOLVING AN OXIDATION-REDUCTION CYCLE. PART II. ISOTOPIC CONFORMATIONAL STUDIES.

(L. C. Card No. Mic 59-519)

Louis Raymond Haefele, Ph.D.
University of Illinois, 1958

Part I

The oxidative hydrolysis of N-benzyl-3,5-dibromophloretamide using bromine water under carefully controlled conditions has been achieved. The products of the reaction, benzylamine and 7,9-dibromospiro[5.4]1-oxadeca-6,9-diene-2,8-dione, confirm the hypothesis that the reaction involves a participation of the activated aromatic ring with the oxygen of the amide carbonyl. A similar reaction, leading to the same dienonelactone, has been observed with 3,5-dibromophloretic acid, and evidence is presented for formation of an analogous product in the bromination of tyrosine in neutral or basic solution.

The usefulness of the reaction as a degradative method for proteins and polypeptides has been discussed.

Part II

A number of monodeuterated cyclohexane derivatives have been synthesized and their infrared spectra in the C-D stretching region have been measured. It was found that an equatorial deuterium on a cyclohexane ring absorbs in the region of 2170-2185 cm^{-1}, the frequency being somewhat lower, in the range of 2140-2160 cm^{-1}, when the isotope is in the axial conformation. The origin of the other bands in this region remains unexplained for the most part.

Conformational analyses were carried out on the compounds where possible, but the results appear to be consistently low, apparently due to some systematic error in the method.

It has been shown that the zinc-acetic acid-d dehalogenation of cyclohexyl bromides is not stereospecific, giving about 80% inversion of configuration with cis-4-bromo-t-butylcyclohexane, and 50% with the corresponding trans-epimer.

The spectrum of cyclohexanone-4d consists of two distinct bands of approximately equal intensity, consistent with a chair-formed structure, or less likely, with a single boat conformation, but inconsistent with the so-called "flexible" conformation.

Cyclohexane-d and cyclooctane-d also exhibit two principal C-D stretching bands in the infrared, in agreement with the restriction of the deuterium substituents to the axial and equatorial orientations. The results obtained with cyclodecane-d indicate that a more flexible system prevails in this case. As might be expected from the multiplicity of orientations of deuterium to be found in even a single conformation of cycloheptane-d, the spectrum of this substance was somewhat complex.

Microfilm $2.00; Xerox $5.40. 108 pages.

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SYNTHESIS AND ATTEMPTED SYNTHESIS OF TETRASUBSTITUTED OXETANONES

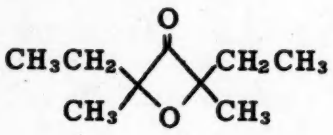
(L. C. Card No. Mic 59-458)

James Leverne Harper, Ph.D.
Emory University, 1958

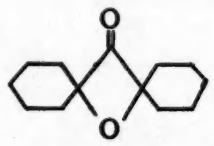
Supervisor: Charles T. Lister

The purpose of this research was to determine whether or not the synthetic approach used by Murr, Hoey and Lester in their synthesis of 2,2,4,4-tetramethyloxetanone was applicable to other tetrasubstituted oxetanones, and if so, to prepare and study other analogous compounds.

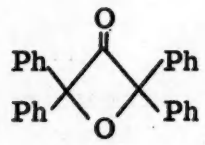
The three compounds chosen for this study were 2,4-dimethyl-2,4-diethyloxetanone-3 (I), bis-2,2,4,4-pentamethyleneoxetanone-3 (II), and 2,2,4,4-tetraphenyloxetanone-3 (III).



I



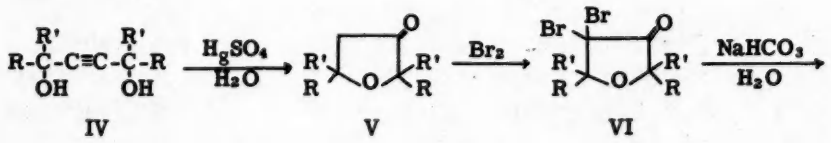
II



III

Both 2,4-dimethyl-2,4-diethyloxetanone-3 (I) and 2,2,4,4-tetraphenyloxetanone-3 (III) were prepared with only slight modification of the synthetic route of Murr, Hoey and Lester; however, bis-2,2,4,4-pentamethyleneoxetanone-3 (II) could not be prepared using their approach under the conditions which were tried.

The synthesis of 2,2,4,4-tetramethyloxetanone-3 reported by Murr, Hoey and Lester was as follows (R and R' are $-CH_3$):



IV V VI

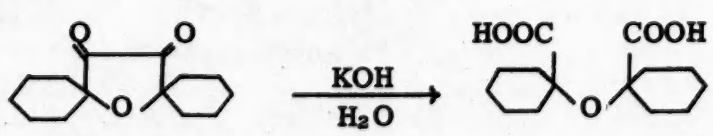


VII VIII IX

In the present work V was oxidized directly to VII by selenium dioxide in the preparation of 2,4-dimethyl-2,4-diethyloxetanone-3 (R is $-CH_3$ and R' is $-CH_2CH_3$).

The conversion of IV into VII was accomplished directly by oxidation of IV with chromic oxide in glacial acetic acid in the synthesis of 2,2,4,4-tetraphenyloxetanone-3 (R and R' are -Ph).

The rearrangement of VII to VIII could not be accomplished in the attempted synthesis of bis-2,2,4,4-pentamethyleneoxetanone-3 (II). The following reaction occurred instead:



It is entirely possible that a more careful study of experimental conditions would lead to the successful synthesis of bis-2,2,4,4-pentamethyleneoxetanone-3 (II).

Microfilm $2.00; Xerox $3.00. 46 pages.

A STUDY OF THE OXYGENATED DERIVATIVES OF d-ALPHA-PINENE AND d-LIMONENE

(L. C. Card No. Mic 58-5146)

Leon Lamar Harrell, Jr., Ph.D.
Emory University, 1953

The citrus industry and the naval stores industry produce large quantities of d-limonene and d-α-pinene. Both industries have difficulty in finding sufficient outlet for these natural products. If processes were developed that would convert these compounds into more valuable or more useful products, the problems facing the citrus and naval stores industries might be solved. The work involved in such a solution could be quite extensive, but, on the other hand, any investigative work on d-α-pinene or d-limonene or their derivatives could contribute to the final solution. With this in mind a study of the behavior of d-α-pinene and d-limonene monoxide toward certain acidic reagents was proposed. In addition, the preparation of trans-8-p-menthane-1,2-diol, as well as a study of the dehydration and oxidation of this diol, was later included.

In order to obtain the d-α-pinene oxide and d-limonene monoxide needed in this work, epoxidation of α-pinene and d-limonene with monoperphthalic acid was decided upon. Difficulty was experienced, however, in the preparation of monoperphthalic acid by the published procedures, and this resulted in a brief study of the cause of the trouble. The difficulty was overcome, and a suggested improvement in the directions was made. In addition, a simplified procedure for the preparation of an ethereal solution of monoperphthalic acid was developed. The advantages of the new procedure are safeness, convenience, applicability to relatively large-scale runs. The yield of monoperphthalic acid with this procedure, 65%, is essentially the same as with the published procedures.

The use of monoperphthalic acid for the epoxidation of d-α-pinene and cyclohexene was investigated for the first time. In addition, a study of the use of this peracid for the epoxidation of d-limonene, previously reported in this laboratory, was extended. The yields of epoxides were d-α-pinene oxide, 49%; d-limonene monoxide, 71%; and cyclohexene oxide, 64%.

The reaction of d-limonene monoxide with glacial acetic acid was investigated under the following conditions; with glacial acetic acid alone, with acetic acid containing 1% sulfuric acid, and with acetic acid containing sodium acetate. The products resulted primarily from two competing reactions, namely, acid-catalyzed isomerization of the oxide and addition of acetic acid to the oxide linkage. With added sulfuric acid, the products resulted almost exclusively from the isomerization reaction while, with added sodium acetate, the products resulted from addition of acetic acid to the oxide linkage. With glacial acetic acid alone, products resulting from both reactions were obtained.

The dehydration of the monoacetate of 8-p-menthene-1,2-diol with p-toluene sulfonic acid in benzene solution produced p-cymene and carvenone. Reaction of the diol with boric acid and pyrolysis of the product produced p-cymene, dihydrocarvone, and a small amount of carveyl acetate. The latter compound is proof of the fact that there was present in the hydroxyacetate at least some secondary acetate.

An attempted isomerization of d-limonene monoxide by

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thermal means alone at 415-430° was unsuccessful. At least 65% of the d-limonene monoxide was recovered unchanged. Isomerization with alumina at 310-325° produced p-cymene, dihydrocarvone and carvenone. The combined yield of the latter two products was 30%. Isomerization of the oxide with zinc chloride in benzene solution produced a 36% yield of dihydrocarvone.

Reaction of dry hydrogen chloride in ether with d-limonene monoxide produced a high yield of halohydrin. Oxidation of the halohydrin mixture apparently proceeded in a straightforward manner with oxidation of the secondary hydroxyl group. Dehydrohalogenation of the oxidation product with boiling pyridine produced some carvone, but in low yield.

Reaction of α-pinene oxide with glacial acetic acid or with acetic acid containing sodium acetate produced as the major product campholenaldehyde. Some high-boiling material, presumably crude glycol acetate, was obtained.

The pertungstic acid-catalyzed hydroxylation procedure was applied to d-limonene for the first time. A 24% yield of pure 8-p-menthane-1,2-diol was obtained in addition to appreciable quantities of other high-boiling, water-soluble material which was not obtained pure. This latter material was probably a mixture of p-menthane-triols and -tetrols.

Attempts to apply the pertungstic acid-catalyzed hydroxylation procedure to α-pinene led to a gross mixture of products from which there was isolated a 3% yield of pinol glycol.

Dehydration of 8-p-menthene-1,2-diol with aqueous oxalic acid produced p-cymene, 37%, and carvenone, 26%. In another experiment in which the products were allowed to steam distill as dehydration proceeded, a crystalline solid, m.p. 78°, was isolated in low yield. This material was not identified.

Attempts to oxidize the secondary hydroxyl group in 8-p-menthene-1,2-diol with potassium dichromate and sulfuric acid and with chromic anhydride in acetic acid were unsuccessful. Microfilm $2.00; Xerox $4.00. 75 pages.

AN INVESTIGATION OF THE FRIEDEL-CRAFTS ACYLATION OF OLEFINS

(L. C. Card No. Mic 58-5147)

Charles Malcolm Hendry, Ph.D.
Emory University, 1950

An investigation of the preparation of α,β-unsaturated ketones by means of the acylation of olefins in the presence of Friedel-Crafts catalysts has been undertaken in order to clarify the confusing literature on this subject and to establish a simple, dependable procedure for application of this reaction in organic synthetic work.

A study has been made of the factors affecting the yield of 1-acetylcyclohexene from the acetylation of cyclohexene with acetyl chloride in the presence of Friedel-Crafts type catalysts. Zinc chloride, aluminum chloride and stannic chloride have been investigated extensively. Catalytic quantities of these catalysts are unsuccessful in promoting high yields of 1-acetylcyclohexene, but 40 per cent yields of this ketone have been obtained employing larger quantities of stannic chloride and aluminum chloride; the optimum catalyst/acid chloride ratios are often less than those employed in aromatic acylations. The common dehydrohalogenation procedures have been investigated and do not quantitatively remove halogen from the products of these acid chloride acylations. The unsaturated ketones prepared in this manner are neither pure nor stable, and this overall method of preparation of α,β-unsaturated ketones is unsatisfactory.

Another study has been made of the factors affecting the yield of 1-acetylcyclohexene from the acetylation of cyclohexene with acetic anhydride in the presence of various Friedel-Crafts catalysts. Again, the catalysts extensively investigated were zinc chloride, stannic chloride, and aluminum chloride. The use of acid anhydrides in the acylation of olefins has been almost completely ignored by most workers. Forty per cent yields of the unsaturated ketone were obtained employing the common procedure of slow addition of the catalyst, zinc chloride or stannic chloride, to a mixture of cyclohexene and acetic anhydride. But the best procedure found during this investigation gives 54 per cent yields of 1-acetylcyclohexene from the dropwise addition of one mole of acetic anhydride to a mixture of one mole of stannic chloride and a mole and a half of cyclohexene, employing a forty-five minute reaction period at 25-35°. This preparation, using an anhydride as acylating agent, offers the following advantages: (1) Considerably higher yields of the desired unsaturated ketone. (2) Easily reproducible reaction conditions. (3) The dehydrohalogenation step is eliminated. (4) The ketone is pure and stable. (5) The overall preparation is short and easily carried out.

This same procedure has been applied to the preparation of a number of other 1-acylcyclohexenes with excellent results. 1-Propionylcyclohexene, 1-butyrylcyclohexene and 1-caproylcyclohexene have been prepared in 48-59 per cent yields from acid anhydrides and cyclohexene. With these higher ketones, the method of bringing the reactants together is less important to yield than in the preparation of 1-acetylcyclohexene; excellent yields are obtained employing either the catalyst-addition or anhydride-addition methods. The preparation of these ketones illustrates the general practicability of the reaction. The best yields of 1-benzoylcyclohexene from either the acid chloride or acid anhydride acylations of cyclohexene were only about 30 per cent. It is recommended that α,β-unsaturated ketones be fractionally distilled under reduced pressure to avoid overheating these highly reactive compounds. This precaution is necessary to avoid extensive resin formation and obtain maximum yields of the desired products.

Chlorocyclohexane is an important side product in the acylation of cyclohexene with both acid anhydrides or acid chlorides.

The study of the acetylation of cyclohexene with acetic anhydride has revealed that the resins produced in these reactions result from the self-polymerization of 1-acetylcyclohexene and/or further reaction of this unsaturated ketone with acetic anhydride. These studies indicate that an excess of Friedel-Crafts catalyst and of the acid anhydride are not conducive to high yields of the unsaturated ketone.

Catalytic quantities of iodine or of orthophosphoric acid do not catalyze the acetylation of cyclohexene with acetic anhydride. The acetylation of this olefin with acetic acid and phosphorous pentoxide also is unsuccessful. The use of boron trifluoride as a catalyst in the acetylation of cyclohexene with acetic anhydride has not given high yields of 1-acetylcyclohexene, but this study is inconclusive.

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Tests on the unsaturated ketones prepared during this investigation revealed that if allowed to stand in contact with air long periods of time, these ketones tend to form hydroperoxides.

1-Acetylcyclohexene has been oxidized to 3,4,5,6-tetrahydrobenzoic acid with potassium hypochlorite and potassium hydroxide.

Mechanisms have been offered and discussed for the acylation of cyclohexene with acid chlorides and acid anhydrides in the presence of Friedel-Crafts type catalysts.

Microfilm $2.00; Xerox $4.20. 76 pages.

KINETICS AND MECHANICS OF THE REACTION OF HYDRAZOIC ACID WITH SUBSTITUTED BENZOIC ACIDS

(L. C. Card No. Mic 59-383)

Melville Ernest Douglas Hillman, Ph.D.
The Ohio State University, 1958

It has been reported by H. R. Barkemeyer and T. Moritsugu that, in general, reactions of hydrazoic acid (1 equivalent) in concentrated sulfuric acid with 3-substituted phthalic acids, 4-substituted isophthalic acids, 2-substituted terephthalic acids, and 2,6-disubstituted terephthalic acids occur exclusively at the hindered carboxyl group to give the corresponding amino acids. It has been suggested that these Schmidt reactions exhibit marked steric acceleration and involve oxocarbonium ions as intermediates.

A spectrophotometric study of the kinetics of reactions of various benzoic acids with hydrazoic acid in excess 95.8 per cent sulfuric acid has now been made. In general the reactions are second-order, first-order with respect to the benzoic acid and to hydrazoic acid. The first-order rate constants for decomposition of hydrazoic acid were determined at 40 (4.74×10^{-4}/min.) and 50° (1.43×10^{-3}/min.) ($\Delta H^{\ddagger}$, 17.0 kcal./mole and $\Delta S^{\ddagger}$, -27.2 e.u.).

A study of the effect of concentration of sulfuric acid (71-97 per cent) on the rate constants for reaction of o-toluic acid with hydrazoic acid was made. The results were satisfactorily correlated with the C_0 acidity function by the equation

$$\log k_2 = \frac{k'}{K'} \frac{c_0}{\left(1 + \frac{h_0}{K} + \frac{c_0}{K'}\right)\left(1 + \frac{h_0}{K_2} + \frac{h_0 h_+}{K_2 K_3}\right)},$$

whose derivation is based on the assumption that unprotonated hydrazoic acid reacts with oxocarbonium ion. In the equation, k' is the rate constant for reaction of unprotonated hydrazoic acid with oxocarbonium ion; K' is the hydrolysis constant for reaction of oxocarbonium ion with water to give unprotonated carboxylic acid; h_0/K is the ratio of dihydroxycarbonium ion to unprotonated carboxylic acid; c_0/K is the ratio of oxocarbonium ion to unprotonated carboxylic acid (c_0 is derived from the Deno acidity function C_0 by the expression $C_0 = -\log c_0$); h_0/K_2 is the ratio of protonated to unprotonated hydrazoic acid; and $h_0 h_+/K_2 K_3$ is the ratio of diprotonated to unprotonated hydrazoic acid. The experimental rate constants could not be correlated by the Hammett acidity function, H_0.

Pronounced proximity effects (steric acceleration) were observed for the reactions of o-substituted benzoic acids. The relative rate constants of reaction of the following benzoic acids at 0° and their enthalpies (kcal. per mole) and entropies (e.u.) of activation respectively, (benzoic acid, 1, 21.7, -2.37) are: o-methyl, 300, 19.2, -0.25; o-ethyl, 753, 17.7, -3.95; o-isopropyl, 2,260, 17.0, -4.28; o-tert-butyl, 15,900, 16.9, -0.72; 2,5-dimethyl, 388, 18.6, -2.08; 2,4-dimethyl, 358, 18.6, -2.07; 2,3-dimethyl, 2,310, 16.7, -5.41· 2,6-dimethyl, 28,900; 2,4,6-trimethyl, 117,000; o-fluoro, 0.66, 22.8, 0.82; o-chloro, 28.8, 21.2, 2.63; o-bromo, 60.2, 20.9, 2.76; o-iodo, 295, 19.0, -0.95; and o-nitro, 5.94, 19.8, -6.03.

The rate constants for reactions of hydrazoic acid with m- and p-substituted benzoic acids were determined and correlated with the Hammett equation (rho = -1.773). Negative (decelerative) deviations for σ^+ substituents were observed and explained by a mechanism which is presently proposed. The relative rate constants at 0° and the enthalpies (kcal. per mole) and entropies (e.u.) of activation respectively for the following benzoic acids are: (benzoic acid, 1, 21.7, -2.37) m-methyl, 1.73, 21.3, -2.79; p-methyl, 1.53, 21.5, -2.20; m-tert-butyl, 2.17, 20.9, -3.76; p-tert-butyl, 1.60, 21.7, -1.60; m-fluoro, 0.220, 22.2, -3.87; p-fluoro, 0.399, 22.8, -0.18; m-chloro, 0.220, 22.5, -2.70; p-chloro, 0.407, 22.7, -0.47; m-bromo, 0.197, 23.3, -0.09; and m-methoxy, 0.252, 23.4, 0.92. In general, electron-withdrawing m- and p-substituents decrease the rates of reaction and increase the enthalpies of activation, whereas electron-donating m- and p-substituents increase the rates of reaction and decrease the enthalpies of activation with respect to benzoic acid.

The enthalpy-entropy relationships found indicate that the carboxylic acids react by similar mechanisms. The mechanism proposed involves attack of unprotonated hydrazoic acid by an oxocarbonium ion to give a protonated benzazide which decomposes in the rate-determining step. Possible participation by the migrating aryl nucleus is discussed. Negative deviations for σ^+ substituents are explained by greater resonance interaction in the initial (ground) state (dihydroxycarbonium ion) than in the rate-controlling transition state.

Microfilm $4.20; Xerox $14.00. 325 pages.

SYNTHESIS AND REACTIONS OF 2,2,4,4-TETRAPHENYL-OXETANONE-3

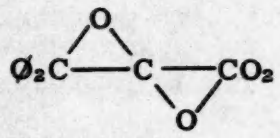
(L. C. Card No. Mic 58-5149)

George Brooke Hoey, Ph.D.
Emory University, 1954

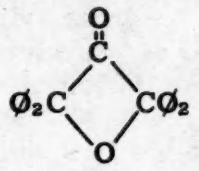
In 1950 Dean reported two new methods of synthesis for the 1,2-diepoxide of tetraphenylallene (I). The diepoxide had been synthesized previously by chromic anhydride oxidation or by nitrosation of tetraphenylallene. The new methods were: (a) dehydrohalogenation of bromotetraphenylacetone in pyridine and (b) photobromination of tetraphenylacetone in a carbon tetrachloride-water solvent system. The percentage yield in all of these syntheses was low (10-38 per cent). Dean found this compound to be unchanged after treatment with strong acids. He found that hydrogen iodide reduced I to 1,1,3,3-tetraphenylpropane and 1,1,3,3-tetraphenylpropene. He also found

methylmagnesium iodide and lithium aluminum hydride to react with I to give new compounds.

It was then noticed that another structural formula for the diepoxide could be written and that this second structure satisfied all the known experimental data. The second structure was II.



I



II

This dissertation is concerned with studies on new and more efficient methods for preparation of this compound and a proof of its structure.

The diepoxide, or oxide, was synthesized by several new procedures. The experimental variables studied were; the solvent, the reaction time and the temperature. The effects of irradiation, bromine, water, molecular oxygen and chemical oxidizing agents also were studied. Tetraphenylacetone and its bromo, hydroxy and acetoxy derivatives were the compounds used in these studies. A two day forced-air autoxidation of tetraphenylacetone in 91 per cent aqueous acetic acid at 110° was found to be the most satisfactory procedure. The yield by this method was 61.5 per cent. Benzophenone, diphenylacetic acid and polymeric material were found to be the other products formed during this autoxidation.

Bromine and irradiation were found to be unnecessary for synthesis of the oxide. One chemical oxidizing agent, mercuric acetate, was found to be unsatisfactory for synthesis of the oxide under the conditions employed.

A conclusive proof of the structure of the oxide was not achieved. Infrared spectroscopic data pointed consistently to structure II as being the correct structure. The infrared spectrum of the oxide showed the presence of both a carbonyl group and the oxetane (trimethylene oxide) group. The infrared spectra of three derivatives of the oxide also showed the frequency characteristic of the oxetane group. Polarographic reduction of the oxide indicated the presence of a carbonyl linkage in the molecule.

The oxide was found to form mono-adducts with methylmagnesium iodide (Dean) and benzylmagnesium chloride. These alcohols could not be dehydrated to the corresponding olefins. Iodine in acetic acid or p-toluenesulfonic acid in p-cymene degraded the benzyl adduct to 1,1,3-triphenylacetone. Neither alcohol was soluble in concentrated sulfuric acid.

Isopropylmagnesium chloride and sodium methoxide were found to reduce the oxide to the same compound isolated by Dean from the lithium aluminum hydride reduction of the oxide. This dihydro-oxide was converted to the oxide by oxidation with chromic anhydride in acetic acid. An Oppenauer oxidation was unsuccessful.

Alkaline cleavage of the oxide under various conditions gave sym-tetraphenyldimethyl ester and an unstable compound tentatively assigned the structure O-benzohydrylbenzilic acid. This acid was degraded to benzilic acid, diphenylacetic acid and diphenylmethane. These alkaline cleavage products are also consistent with suggested structure II.

Bromination of tetraphenylacetone in acetic acid gave a new compound (or compounds) which was converted to a second new compound by treatment with ethanol or aqueous dioxane. The identity of these compounds was not established.

Many other reactions were attempted with tetraphenylallene and tetraphenylacetone and its derivatives. Tetraphenylallene could not be epoxidized or hydroxylated even under vigorous conditions. Tetraphenylallene was isomerized to 1,1,3-triphenylindene by treatment with 98 per cent formic acid. Hydroxytetraphenylacetone was converted to the oxide by either bromine in carbon tetrachloride or chromic anhydride in acetic acid. Treatment of bromotetraphenylacetone with silver nitrate in various solvents gave hydroxytetraphenylacetone as the only product isolated. Treatment of bromotetraphenylacetone with sodium methoxide in methanol gave the oxide as one product. Tetraphenylacetone failed to react with thioglycolic acid and the ketone was cleaved to diphenylmethane under the conditions of the Wolf-Kishner-Huang-Minlon reduction.

The structures of hydroxy-, methoxy- and, presumably, ethoxytetraphenylacetone have been conclusively proven by infrared spectral data for these compounds and a Zerewitinoff determination on the hydroxyketone.

Procedures are described for the preparation of hydroxytetraphenylacetone, acetoxytetraphenylacetone and tetraphenylallene in 90, 70 and 22 per cent yield respectively. Microfilm $2.10; Xerox $7.40. 159 pages.

THE PREPARATION AND PROPERTIES OF SOME SYNTHETIC GLYCERIDES

(L. C. Card No. Mic 59-1273)

John Edward Jackson, Ph.D.
University of Minnesota, 1958

Adviser: W. O. Lundberg

In a study of the synthesis of glycerides of the fatty acids the migration of acyl groups during the removal of trityl groups from tritylated intermediates was shown to depend upon the solvent in which detritylation was effected, and simplified and improved methods for preparing monotritylglycerol, linoleic acid and acyl chlorides were developed. The improved procedures were used in the synthesis of the difficultly obtainable 2-monoglycerides and 1,2-diglycerides, and in the synthesis of triglycerides comprising all of the possible combinations of stearic acid and linoleic acid with glycerol.

The linoleoyl radical was introduced as the tetrabromostearoyl derivative so that all compounds could be handled as solids thus eliminating oxidative contamination. Investigation of methods of removal of bromine to re-form the double bonds showed that the formation of trans double bonds could be minimized by using comparatively large amounts of aqueous concentrated hydrochloric acid to catalyze the reaction with zinc dust in diethyl ether.

Diglyceride intermediates for the preparation of mixed triglycerides were prepared by reaction of the desired acyl chloride with monotritylglycerol followed by removal of the trityl group. When detritylation by gaseous hydrochloric acid was effected in diethyl ether, acyl migration occurred and the 1,3-diglyceride was formed; in petroleum ether, acyl migration did not occur and the product was the 1,2-diglyceride.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

To further demonstrate the effect of solvent, symmetrical and unsymmetrical monoglycerides were prepared from acylated 1,3-ditritylglycerol. Detritylating in diethyl ether, 1-monoglycerides were obtained; in petroleum ether, 2-monoglycerides were obtained.

Conversion of 1,2-distearin to 1,3-distearin occurred when the 1,2-distearin was further treated with gaseous hydrochloric acid in diethyl ether. This conversion did not occur in petroleum ether, nor could 1,3-distearin be converted to 1,2-distearin in either solvent. Both 1,2- and 1,3-tetrabromostearoyl glycerides were unchanged by further acid treatment.

For the identification of these compounds and the determination of their purity, the best criteria were shown to be melting point data. Melting points of the polymorphic forms of the stearoyl glycerides were shown to lie on a family of parallel straight lines when the melting points were plotted against the number of ester linkages in each of the glycerides. Melting points of the tetrabromostearoyl glycerides, on the other hand, conformed to a family of straight lines converging to the melting point of tetrabromostearic acid considered as the compound having zero ester linkages.

Infrared spectra were shown to be unreliable for establishing the purity of the intermediates or of the final glycerides. Spectra obtained by the solution, potassium bromide pellet and solid or liquid film techniques were compared. No single absorption maximum useful for determining the symmetry of all classes of glycerides was discernable in any of the spectra. Solid film spectra of the symmetrical mono- and diglycerides tended to show more detail in the region from 9.5 to 13.5 microns than did the spectra of the corresponding unsymmetrical glycerides, but absorption bands in this region as well as in the progression band region, from 7.42 to 8.47 microns, decreased in number and prominence when tetrabromostearoyl radicals were part of the molecule, and were largely missing from the spectra of glycerides containing linoleoyl radicals. Spectra of the triglycerides, and the solution spectra of all three kinds of glycerides, were superimposable with minor exceptions.

Microfilm $2.70; Xerox $9.40. 207 pages.

THE KINETICS AND MECHANISM OF THE PERCHLORIC ACID-CATALYZED REARRANGEMENT OF 1,1-DIPHENYL-2-p-FLUOROPHENYL-2-p-METHOXYPHENYL-1,2-ETHANEDIOL IN ACETIC ACID

(L. C. Card No. Mic 59-905)

Theodore Carl Kraus, Ph.D.
St. Louis University, 1958

A kinetic study has been made of the perchloric acid-catalyzed rearrangement of 1,1-diphenyl-2-p-methoxyphenyl-2-p-fluorophenyl-1,2-ethanediol in acetic acid containing from 0% to 3.65% of water. The rearrangement products, formed in a molar ratio of approximately 1:1, were found to be pinacolone I, 1-p-fluorophenyl-2,2-diphenyl-2-p-methoxyphenylethanone-1, formed by the shift of the p-methoxyphenyl group and pinacolone II, 1-phenyl-2-phenyl-2-p-fluorophenyl-2-p-methoxyphenylethanone-1, formed by the shift of a phenyl group. The pinacol was found to decay at a rate (k_p) approximately twenty times faster than the rate of pinacolone formation indicating storage of a reaction intermediate. This was isolated and found to be the corresponding ethylene oxide. The reaction scheme was shown to be

$$\text{Pinacol} \xrightarrow{k_1} \text{Oxide} \xrightarrow{k_2} \text{Pinacolone}, \quad \text{Pinacol} \xrightarrow{k_3} \text{Pinacolone}$$

The specific rates were found to be in the ratio $k_1 : k_2 : k_3 = 20 : 1.5 : 1$. The measured value of k_p ($k_p = k_1 + k_3$) was found to be larger than that previously reported for benzopinacol, measured under the same conditions, by a factor of 45. The difference is attributable principally to the effect of the p-methoxy substituent which would be expected to have a marked stabilizing effect on the carbonium ion formed at C-2.

The product ratio and kinetic measurements can be rationalized if it is assumed (1) that the rates of carbonium ion formation at C-1 and C-2 are in the ratio of 1:115 in the pinacol and 1:30 in the oxide; (2) that every carbonium ion C-1 undergoes a shift of the highly mobile p-methoxyphenyl group of C-2 without competition from ring closure; and (3) that the carbonium ions at C-2 react both by ring closure and phenyl shift at relative rates of 30:1.

Experiments with an optically impure sample of the pinacol which contained an excess of the (+) isomer relative to the (-) showed the polarimetric rate to be 74% faster than the rate of pinacol decay (based on oxidation with lead tetraacetate) in acetic acid containing 3% of water. In the anhydrous solvent the titrimetric rate exceeded the polarimetric by 57%. These observations suggest (1) that in the aqueous solvent some reversible return of the carbonium ion C-2 to the pinacol occurs; and (2) that in the anhydrous solvent, ring-closure involving the hydroxyl group of C-1 in some instances occurs before the carbonium ion becomes free. There is, however, no kinetic evidence for participation by this hydroxyl group in the rate-determining ionization.

The specific rates k_p', k_2', and k_3' were found to correlate with the values of the Hammett acidity function, the slope of this line $\Delta \log k/\Delta H_o$, being -0.87. These results are consistent with a mechanism involving a reversible proton transfer to the substrate followed by a rate-determining formation of the carbonium ion:

$$\text{ROH} + \text{H}^+ \rightleftharpoons \text{ROH}_2^+ \quad \text{(equilibrium)}$$
$$\text{ROH}_2^+ \longrightarrow \text{R}^+ + \text{H}_2\text{O} \quad \text{(slow)}$$
$$\text{R}^+ \longrightarrow \text{Products} \quad \text{(fast)}$$

The H_o-acidity function - reaction rate correlation, together with the result of the experiments with the optically active pinacol, definitely exclude the alternate mechanism:

$$\text{ROH} + \text{H}^+ \rightleftharpoons \text{R}^+ + \text{H}_2\text{O} \quad \text{(equilibrium)}$$
$$\text{R}^+ \longrightarrow \text{Products} \quad \text{(slow)}$$

The results of this study clearly show the significance of the formation of the substituted ethylene oxide intermediates in the rearrangement of the aryl pinacols. Ring-closure, which competes with rearrangement more

successfully in some carbonium ions than in others, may drastically alter the product ratio which would be observed if every carbonium ion formed were capable of reacting exclusively by rearrangement.

Microfilm $2.00; Xerox $5.00. 97 pages.

THE CATION CATALYSIS OF NUCLEOPHILIC ATTACK ON ACETYL PHOSPHATE

(L. C. Card No. Mic 59-1347)

Joseph Louis Kurz, Ph.D.
Washington University, 1958

Chairman: C. David Gutsche

A study has been made of the kinetics of the disappearance of acetyl phosphate in N,N-dimethylglycine-N,N-dimethylglycinate and glycine-glycinate buffers. The effects of the concentration of the buffer species, of pH, of the identity and concentrations of the cations present, of solvent, and of temperature were investigated.

The variation of this rate of disappearance with changes in the concentrations and identity of the buffer species was analyzed in terms of a model which assumed that this disappearance was due to nucleophilic attack on acetyl phosphate ($AcPO_4^=$) by four species: water, hydroxide ion, glycinate ion (G^-), and glycine zwitterion (HG). The overall rate equation was thus written as

$$\frac{-d[AcPO_4]}{dt} = (k_w[H_2O] + k_{OH}a'_{OH} + k_G[G^-] + k_{HG}[HG])[AcPO_4^=]$$

where a'_{OH} is the pH-meter determined hydroxide ion activity, and the quantities in brackets are concentrations. Hydroxide and glycinate ions were assumed to attack at the carbonyl carbon, and water at the phosphorus. Glycine zwitterion was postulated to react through the concerted donation of a proton to the phosphate and attack of the nitrogen at the carbonyl carbon. The hydrolysis rate was unchanged by doubling the concentration of the dimethylglycine buffer.

The effect of cations on the bimolecular rate constants and on their variation with changes in solvent and temperature have been discussed in terms of an association model. This model has been considered in terms of both the activity coefficient formulation, which assumes the relative stabilization of the transition state of the reactants through association, and the alternate path formulation, which assumes the introduction of a new mechanism involving associated reactants. These two formulations are equivalent.

In 50% dioxane at 0°, k_w increases and k_{HG} decreases with increasing $[Li^+]$, each reaching a plateau near $[Li^+]$ = 0.3 N. In contrast, k_G and k_{OH} both show large increases but reach no plateau, k_{OH} becoming linear in $[Li^+]$ at high concentrations. When tetramethylammonium ion is the only cation present, k_{OH} can not be detected, and the other rate constants show small linear increases with increasing cation concentration. Tetramethylammonium ion inhibits the effect of lithium ion. Sodium ion has effects similar to, but smaller than, Li^+. In analogous systems using water as the solvent, two effects are prominent. All four rate constants show smaller variation with increasing Li^+, and k_w, k_{HG}, and k_G have much lower values than in 50% dioxane. (The uncertain relation between the pH scales prohibits comparison of k_{OH} in the two solvents.)

The temperature effects were expressed in terms of $\Delta H^‡$ and $\Delta S^‡$ as calculated from the Eyring equation. Both $\Delta H^‡$ and $\Delta S^‡$ for the ion-ion reactions in 50% dioxane solution decrease with increasing $[Li^+]$, while they increase for k_w and k_{HG}. The effects of tetramethylammonium ion are small.

All these observations, with the exception of the behavior of the activation parameters for k_w, are consistent with the following assumptions. (1) In water, there is little or no association of cations with doubly or singly charged anions, although some association with triply charged transition states does occur. (2) In 50% dioxane, there is association with all anions, the association constants increasing with the charge and polarizability of the anion. The charge and polarizability of the transition state relative to the reactants is predictable from the proposed mechanisms. (3) Although tetramethylammonium ion associates, it has a very low ability to polarize the anions.

Preliminary studies were also made of the effect on the rates of a cationic polyelectrolyte and of an anion exchange resin.

BIOGRAPHICAL DATA

Date of Birth:	Dec. 13, 1933. Place of Birth: St. Louis, Mo.
Undergraduate Study:	Washington University, 1952-1955.
Graduate Study:	Washington University, 1955-1958.
Scholastic and Professional Experience:	Teaching Assistant, Washington University, 1956-1957.
Membership in Scholastic and Professional Societies:	Sigma Xi American Institute of Chemists Federation of American Scientists.
Honors:	Monsanto Fellow, 1955-1956 Du Pont Fellow, 1957-1958.

Microfilm $2.00; Xerox $6.00. 122 pages.

THE REACTION OF VARIOUS GRIGNARD REAGENTS WITH A SERIES OF ALKYL p-ALKYLPHENYL KETONES

(L. C. Card No. Mic 58-5157)

Billy Frank Landrum, Ph.D.
Emory University, 1950

The reaction of a Grignard reagent with an aldehyde or ketone can take any one of four courses; normal addition, enolization, reduction and condensation. A series of ketones, which are not condensed by a Grignard reagent, have been selected for study.

The conditions of the reactions of the selected ketones have been held constant as to concentration, temperature, reaction time and order of addition. The course and extent

of the reactions have been followed by collecting any gas evolved and analyzing it for saturated and unsaturated components. The results have been confirmed by separating and characterizing the products of the reactions.

The results of the gas analyses, indicating the course of the reaction, are reported in Tables I, II and III.

TABLE I

ACTIVE HYDROGEN DETERMINATION AND REACTION WITH ETHYLMAGNESIUM BROMIDE

KETONE	ACTIVE HYDROGEN	ADDITION	ENOL.	REDUCTION
Acetophenone	9	97	3	0
p-Methyl Acetophenone	8	96	3	1
p-Ethyl Acetophenone	9	93	5	2
p-Isopropyl Acetophenone	7	93	6	1
p-t-Butyl Acetophenone	7	94	5	1
Propiophenone	3	98	2	0
p-Methyl Propiophenone	3	96	3	1
p-Ethyl Propiophenone	3	97	2	1
p-Isopropyl Propiophenone	4	97	2	1
p-t-Butyl Propiophenone	3	97	2	1
Isobutyrophenone	2	98	0	2
p-Methyl Isobutyrophenone	2	98	0	2
p-Ethyl Isobutyrophenone	3	97	0	3
p-Isopropyl Isobutyrophenone	3	96	0	4
p-t-Butyl Isobutyrophenone	3	99	0	1
Pivalophenone	-	14	-	86
p-Methyl Pivalophenone	-	13	-	87

TABLE II

REACTION WITH ISOPROPYLMAGNESIUM BROMIDE

KETONE	ADDITION (%)	ENOL. (%)	REDUCTION (%)
Acetophenone	74	24	2
p-Methyl Acetophenone	64	29	7
p-Ethyl Acetophenone	59	34	7
p-Isopropyl Acetophenone	62	31	7
p-t-Butyl Acetophenone	56	34	9
Propiophenone	89	5	6
p-Methyl Propiophenone	86	7	7
p-Ethyl Propiophenone	83	7	10
p-Isopropyl Propiophenone	82	8	10
p-t-Butyl Propiophenone	82	7	11
Isobutyrophenone	68	3	29
p-Methyl Isobutyrophenone	60	5	35
p-Ethyl Isobutyrophenone	60	5	35
p-Isopropyl Isobutyrophenone	58	5	37
p-t-Butyl Isobutryophenone	59	3	38
Pivalophenone	7	-	93
p-Methyl Pivalophenone	9	-	91

TABLE III

REACTION WITH tert-BUTYLMAGNESIUM BROMIDE

KETONE	ADDITION (%)	ENOL. (%)	REDUCTION (%)
Acetophenone	81	0	19
p-Methyl Acetophenone	67	0	33
p-Ethyl Acetophenone	68	0	32
p-Isopropyl Acetophenone	67	0	33
p-t-Butyl Acetophenone	68	0	32
Propiophenone	96	0	4
p-Methyl Propiophenone	89	0	11
p-Ethyl Propiophenone	87	0	13
p-Isopropyl Propiophenone	87	0	13
p-t-Butyl Propiophenone	87	0	13
Isobutyrophenone	95	0	5
p-Methyl Isobutyrophenone	89	0	11
p-Ethyl Isobutyrophenone	89	0	11
p-Isopropyl Isobutyrophenone	89	0	11
p-t-Butyl Isobutyrophenone	87	0	13
Pivalophenone	89	-	11
p-Methyl Pivalophenone	75	-	25

This investigation has tended, in part, to substantiate the mechanism of the Grignard reaction as suggested by Whitmore. The study has also produced some results which are not compatible with this mechanism.

The fact that reduction does not increase, but falls off in the reaction between t-butylmagnesium chloride and the ethyl, isopropyl, and t-butyl ketones, is interpreted as an indication of a second mechanism contributing to the reaction.

This second mechanism is believed to involve initial coordination of the carbonyl with one molecule of Grignard reagent followed by a rate controlling attack on the complex by another molecule of Grignard reagent. Evidence from the literature supporting this theory is reported and discussed.

Distillation of the ether solution of the reaction mixture obtained by the reaction of t-butylmagnesium chloride with pivalophenone, gave an appreciable quantity of isobutylene. It is suggested that the isobutylene was liberated by decomposition of the tertiary alcohol, di-t-butylphenylcarbinol.

The new carbinols arising from this study have been isolated and characterized. Carbon and hydrogen analyses have been made on all new compounds.

Microfilm $2.00; Xerox $3.60. 64 pages.

CATALYTIC ALKYLATIONS AND HYDROGEN TRANSFER REACTIONS

(Publication No. 23,446)

Bernard Charles Lawes, Ph.D.
Brown University, 1957

In a further study of a reaction first reported by L. T. Plante, (Ph.D. Thesis, Brown University, 1955), nitroparaffins were found to react with alcohols at 200°C in the presence of Raney nickel to give a 15-35% yield of amines. The amines contained only alkyl groups from the alcohol; for example, triethylamine was formed in 33% yield from 2-nitropropane and ethanol in the presence of nickel. Nitroethane and ethanol yielded 0-13% acetamide and large amounts of polymer, containing nitrogen, as well as 15-25% triethylamine. The reaction involved the decomposition of the nitroparaffin to ammonia (isolated), which was alkylated by the dehydrogenated alcohol to yield the amine, and polymers arose from alkylation following aldol condensations.

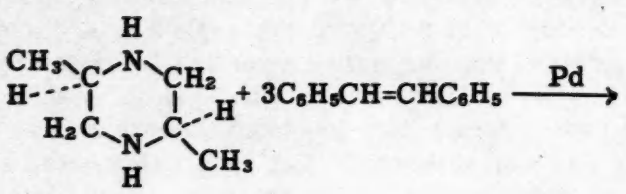
When the nitroparaffin was first reduced with hydrogen and nickel, and then reacted at 200°C with an alcohol and nickel, 80-90% yields of amines were obtained. When the nitroparaffin and alcohol contained the same alkyl groups, 80-90% yields of the symmetrical amines were obtained, e.g., a 90% yield of triethylamine from the reaction of reduced nitroethane and ethanol. When the alkyl groups of the two reactants were different, a mixture of amines was obtained. For example, from reduced nitromethane and n-propyl alcohol was obtained 8% of n-propyldimethylamine, 7% of di-n-propylamine, 47% of di-n-propylmethylamine, and 23% of tri-n-propylamine. The di-n-propylmethylamine probably resulted from the alkylation of reduced nitromethane (methylamine) with two moles of dehydrogenated n-propyl alcohol. The other amines probably resulted from the dehydrogenation of methylamine

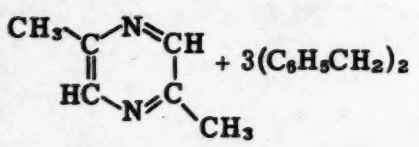
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followed by condensation of the resulting methylenimine with other amines present.

A study of hydrogen transfer reactions of piperazines showed that in the presence of palladium under refluxing conditions (e.g., with ethanol as a solvent), piperazines can act as hydrogen donors to give up their hydrogen to unsaturated acceptors. Piperazine and cis-2,5-dimethylpiperazine underwent a slow reaction with nitrobenzene resulting in 16-21% yields of aniline. cis-2,5-Dimethylpiperazine and N-nitrosomethylaniline gave rise to an 87% yield of N-methylaniline.

trans-Stilbene also was found to undergo hydrogen transfer with piperazines in the presence of palladium to yield dibenzyl. The overall reaction probably proceeds according to the following equation for cis-2,5-dimethylpiperazine and trans-stilbene:





Some 2,5-dimethylpyrazine was isolated, and the reaction with an excess of stilbene indicated that three moles of stilbene were reduced by one mole of the piperazine. However, the reaction involves initial stepwise dehydrogenation of the piperazine, presumably to tetrahydro- and dihydropyrazines. Hydrogenation at one atmosphere of the reaction mixture from hydrogen transfer between cis-2,5-dimethylpiperazine and trans-stilbene in a 1:1 molar ratio indicated that about 60% of the reduction of the stilbene resulted from the dehydrogenation of the piperazine to intermediate dehydrogenation products. Further evidence for the formation of such intermediates was the presence of an absorption peak at 5.97 microns (1675 cm^{-1}) in the infrared spectrum of the reaction mixture of cis-2,5-dimethylpiperazine and trans-stilbene. This peak, suggestive of C=N absorption, was not present after the reaction mixture was hydrogenated at one atmosphere.

Although the presence of an acceptor was found necessary to dehydrogenate the piperazine, palladium was found to catalyze the conversion of cis-2,5-dimethylpiperazine to the trans isomer. Of the various piperazines tested for hydrogen transfer with trans-stilbene, the following decreasing order of reactivity was discovered: cis-2,5-dimethylpiperazine > trans-2,5-dimethylpiperazine > piperazine ≫ 2,2,5,5-tetramethylpiperazine. These reactivities can be rationalized on the basis of steric effects of methyl substituents, and relative stabilities of dehydrogenation products.

Appendix

A determination was made of the reaction products from the hydrolysis of 2,2-dimethylethylenimine and 2-ethylethylenimine with excess dilute perchloric acid at 25°C by fractionation of the isolated amino alcohol mixtures. The hydrolysate of 2,2-dimethylethylenimine was found to consist of 84.6% of 1-amino-2-methyl-2-propanol and 15.4% of 2-amino-2-methyl-1-propanol, while the hydrolysate of 2-ethylethylenimine was found to consist of 22.4% of 1-amino-2-butanol, 60.5% of 2-amino-1-butanol, and 17.1% of higher boiling polymeric material.

Microfilm $2.00; Xerox $6.60. 140 pages. Mic 58-5236.

SYNTHESIS AND PROPERTIES OF BIS(β-DIKETONES)

(L. C. Card No. Mic 59-767)

Dean Frederick Martin, Ph.D.
The Pennsylvania State University, 1958

During the course of an investigation into the synthesis and properties of coordination polymers, bis(β-diketones) of the following types were prepared:

I. $RCOCH_2CO\text{-}Y\text{-}COCH_2COR$

II. $[(RCO)(R'CO)CH]_2CHR''$

III. $(RCO)(R'CO)CH\text{-}Y\text{-}CH(COR)(COR')$

Compounds of Type I were using one of three synthetic methods:

1. $RCOCH_3 + R'OOC\text{-}Y\text{-}COOR' \xrightarrow{base}$
2. $RCOOR' + CH_3CO\text{-}Y\text{-}COCH_3 \xrightarrow{base}$
3. $(RCOCH_2)\overset{+}{N}a + ClCO\text{-}Y\text{-}COCl \xrightarrow{base}$

The following new bis(β-diketones) of Type I have been prepared: R = C_6H_5, Y = $(CH_2)_4$, $(CH_2)_5$, $(CH_2)_6$, $(CH_2)_7$, 1,3-C_6H_4, 1,4-C_6H_4, and 4,4'-$C_6H_4C_6H_4$; R = 4-$CH_3OC_6H_4$, Y = 1,4-C_6H_4; R = $CH_2{=}CH(CH_2)_2$, Y = 1,3-C_6H_4 and $(CH_2)_8$. It should be noted that Method 3 permits the preparation of the compounds for which Y = $(CH_2)_4$ and $(CH_2)_5$; Method 1 cannot be used because of (Dieckmann) cyclization. For a similar reason, the compound for which Y = $(CH_2)_4$ cannot be prepared by Method 2.

Compounds of Type II were prepared by the interaction of a β-diketone, $RCOCH_2COR'$, and an aldehyde, R"CHO, in the presence of piperidine. The following compounds were prepared using this method: R = R' = CH_3, R" = $(CH_2)_5CH_3$, 2-ClC_6H_4, 2-$CH_3OC_6H_4$, 4-$CH_3OC_6H_4$, 4-$(CH_3)_2NC_6H_4$, 3,4-$CH_2O_2C_6H_3$, 2-C_5H_4N, 3-C_5H_4N, 4-C_5H_4N; R = CH_3, R' = CH_3OCH_2, R" = C_6H_5, 4-$CH_3OC_6H_4$, 4-HOC_6H_4, 3,4-$CH_2O_2C_6H_3$, 4-$(CH_3)_2NC_6H_4$, 2-C_5H_4N, 4-C_5H_4N.

Compounds of Type II offer the best opportunity for obtaining a fairly wide structural variation with a minimum of effort. However, the condensation was not successful for β-diketones containing a trifluoroacetyl group. There is reason to believe that in one instance the bis(β-diketone) had undergone hydrolytic cleavage.

The following bis(β-diketones) of Type III were prepared by the reaction of acetylacetone and a dihalide in a t-butanol solution of potassium t-butoxide: R = R' = CH_3, $\overline{Y}$ = $(CH_2)_6$, $(CH_2)_{10}$, 1,4-$(CH_2)_2\overline{C}_6H_4$.

The infrared and ultraviolet absorption spectra indicate that in the solid state and in 95% ethanol, compounds of Type I exist predominantly in the enolic form;

compounds of Types II and III appear to have much less tendency to exist in the enolic form.

Microfilm $2.05; Xerox $7.20. 153 pages.

STUDIES IN THE TETRAARYLETHYLENES, THE PRODUCTS OF CHLORINATION OF TETRAPHENYLETHYLENE AND SOME OF ITS DERIVATIVES; SOME CHEMICAL PROPERTIES OF TETRAPHENYLETHYLENE DICHLORIDE.

(L. C. Card No. Mic 59-910)

Roger Minor McKinney, Ph.D.
St. Louis University, 1958

Tetraphenylethylene dichloride has been reported[1] to exist in two separable stereoisomeric forms because of restricted rotation in the ethane bond. One isomer, of melting point 172°, was reported to have been produced by the chlorination of tetraphenylethylene in chloroform or by the action of hydrogen chloride on a benzene solution of the isomer which melted at 185°. The latter product was obtained by chlorination of the olefin in carbon tetrachloride. In the absence of authentic instances of other separable rotational isomers among the substituted ethanes, a reinvestigation was made of the chlorination products of tetraphenylethylene.

In this investigation it was observed that the rate of addition of chlorine to tetraphenylethylene in chloroform was very rapid and that the product remained in solution. Upon concentration of the solution tetraphenylethylene dichloride crystallized as an unstable disolvate. The product became solvent-free within a few hours at room temperature. It melted at 183°, in agreement with the melting point reported by Finkelstein[2] for tetraphenylethylene dichloride prepared by the reaction of diphenyldichloromethane with sodium iodide in acetone.

In carbon tetrachloride the rate of addition of chlorine to tetraphenylethylene was observed to be relatively slow. At room temperature the product separated as formed over a period of several hours and was almost completely insoluble in carbon tetrachloride. It melted fairly sharply with decomposition but the melting point was variable. This product was found to be a non-stoichiometric complex or mixture of tetraphenylethylene dichloride, tetraphenylethylene and carbon tetrachloride. The olefin content and melting point varied with the temperature of chlorination from 22%, m.p. 205° at -18° to 1%, m.p. 183-184° at 40°. The product of chlorination at 25° contained 7% olefin and melted at 195°. Olefin contents were determined spectrophotometrically. Upon dissolving the product in benzene and reprecipitating with several volumes of carbon tetrachloride six times a virtually olefin-free product was obtained. This separated as a disolvate with carbon tetrachloride and became solvent free within 24 hours at room temperature. The product melted at 183° and was identical in every respect with that obtained from chloroform. The presence of the olefin caused a marked increase in the stability of the solvate formed from either chloroform or carbon tetrachloride.

On the basis of these results it is believed that at present there exists no evidence for the existence of more than one isolable form of tetraphenylethylene dichloride.

Tetra-p-tolylethylene dichloride and tetrakis (4-chlorophenyl) ethylene dichloride were prepared by the addition of chlorine to the corresponding olefin with the use of both chloroform and carbon tetrachloride as the solvent. The products obtained from chloroform and from carbon tetrachloride were identical in both cases and in no case was the formation of addition products with solvent and olefin observed.

The reactions of tetraphenylethylene dichloride with dioxane, methanol and methanol containing sodium methoxide were investigated and the products of these reactions were isolated. Tetraphenylethylene dichloride was found to react with methanol and sodium methoxide to give 4-methoxytetraphenylethylene and a dimethoxytetraphenylethane which is believed to be 1,1-dimethoxytetraphenylethane. Refluxing tetraphenylethylene dichloride in dioxane gave tetraphenylethylene.

These reactions of tetraphenylethylene dichloride, as well as others reported in the literature, can be rationalized if it is assumed that the carbonium ion formed by the dissociation of a chloride ion does not readily rearrange to the less stable secondary carbonium ion, but rather reacts in one of three ways: (a) by elimination of a chloronium ion from C_β, (b) by addition of a solvent molecule to the C_α, or (c) by attack of a strong nucleophile on the para position of one of the benzene rings attached to the electron-deficient C_α, this position being activated by charge dispersal in the carbonium ion.

Microfilm $2.00; Xerox $4.20. 80 pages.

1. H. LI. Bassett, N. Thorne and C. J. Young, J. Chem. Soc., 85 (1949).

2. H. Finkelstein, Ber., 43, 1535 (1910).

A KINETIC STUDY OF THE EFFECT OF ORTHO SUBSTITUENTS ON THE PERCHLORIC ACID-CATALYZED OLEFIN ELIMINATION FROM SOME DERIVATIVES OF BENZYLDIPHENYLCARBINOL AND ITS ACETATE ESTER IN ACETIC ACID

(L. C. Card No. Mic 59-912)

Sister Cecilia Louise Moore, C.S.J., Ph.D.
St. Louis University, 1958

With the aid of ultraviolet spectrophotometry the kinetics of acid-catalyzed olefin formation of the following new compounds have been investigated: 1,1-bis(o-chlorophenyl)-2-phenylethanol and its acetate ester; 1,1-bis(o-methoxyphenyl)-2-phenylethanol; and 1,1-di-o-tolyl-2-phenylethanol and its acetate ester. The purpose of the study was to determine some of the effects of ortho substituents upon the properties of the carbonium ions which are believed to be meta-stable reaction intermediates in these reactions. Previous studies in this laboratory of 1,1,2-triphenylethanol and of some of its para-substituted derivatives provide support for the following mechanism in which the decomposition of the protonated substrate by unimolecular alkyl-oxygen fission is the rate-determining step:

$$ROH + H^+ \rightleftharpoons ROH_2^+$$
$$ROAc + H^+ \rightleftharpoons RHOAc^+$$
$$\rightleftharpoons R^+ \longrightarrow \text{Olefin}$$

This same mechanism adequately explains the kinetic results of the present investigation of the ortho-substituted analogues with the exception that the decomposition of $RHOAc^+$ has been shown to be essentially irreversible.

The compounds studied were found to be in the following order of decreasing activity: methoxy-substituted > methyl-substituted > chloro-substituted. Such a sequence is consistent with predictions based on the electronic theory of organic chemistry and the proposed reaction mechanism.

In every instance the ortho-substituted compounds were less reactive than the corresponding para-substituted derivatives. The decreased rate is principally due to the increase in energy of activation of the ortho compound relative to that of the para isomer, rather than to any marked difference in the entropy of activation. The higher activation energies of the ortho-substituted compounds appear to be in part due to a steric inhibition of resonance of the carbonium ion intermediate.

The most pronounced effect of the ortho substituents is to diminish k_1 and k_{-1} relative to k_2 and k_3 which is interpreted as being of a steric rather than of an electronic origin since it is characteristic of the ortho-substituted compounds with electron-releasing as well as electron-attracting substituents.

$$\begin{array}{ccc} \text{acetic acid + carbinol} & \xrightarrow{k_3} & \\ k_1 \downarrow \quad \uparrow k_{-1} & & \text{olefin} \\ \text{water + ester} & \xrightarrow{k_2} & \end{array}$$

The effect of the ortho group is essentially to eliminate the reaction of the carbonium ion intermediate with acetic acid and to retard its reaction with water to such an extent that olefin formation by proton loss from the β-carbon atom is the dominant reaction.

Microfilm $2.00; Xerox $5.60. 112 pages.

ALKYL ARYL KETONES AND CARBINOLS: OXIME FORMATION AND AMINOETHERS.

(L. C. Card No. Mic 58-5172)

John Roscoe Proffitt, Jr., Ph.D.
Emory University, 1950

PART I

OXIME FORMATION

As early as 1901 the rate of oxime formation was under investigation. Since this date many workers have entered the field. The result of their researches have shown the following to be true of oxime formation. The reaction has been shown to be reversible but for most compounds the equilibrium point lies far on the oxime side of the reaction.

1. $R_2C{=}O + H_2NOH \rightleftharpoons R_2C{=}NOH + H_2O.$

The reaction has been shown to occur between the hydroxylamine and the ketone, not the hydroxylamine hydrochloride and the ketone. Not only has the reaction been shown to be acid catalyzed but also it has been shown that the oximation of a ketone or aldehyde undergoes general acid catalysis. These last two observations must be considered carefully in making a study of the rate of oximation, for an acid component can be used as a catalyst but the hydroxylamine must be present as the free base. It would be expected then that the rate of oximation is a function of the pH of the reacting medium and, indeed, it has been shown that as the pH of the reaction medium is varied that rate of reaction will pass through a maximum. It has been shown that an intermediate compound is formed which loses water to yield the oxime. The rate of this dehydration has been measured, the process has been shown to be reversible and the rate of addition of water to the oxime has been measured. The kinetics of the reaction have been shown to be of the second order if a buffer is used.

Despite all the work done in the field of oximation, no one has investigated the rate of oximation of a homologous series of more than three members and no one has studied the rate of oximation of a group of related homologous series in the same medium. Under the direction of Dr. Charles T. Lester a group of workers at this University synthesized a group of homologous series and began the measurement of the oximation rates of the several alkyl aryl ketone series in the same medium. It is hoped that, when all the investigations are complete and a comparison of all the rates is made, conclusions concerning the effect of alkyl side chains on the benzenoid nucleus can be drawn.

The work described in the main report is a part of an overall program on rate studies of oximation. The homologous series studied was the n-alkyl phenyl ketone compounds beginning with acetophenone and ending with caprylophenone. The first two ketones, acetophenone and propiophenone, were carefully purified in the same manner as the rest of the ketones. The ketones butyrophenone through caprylophenone were prepared by the conventional Friedel and Crafts acylation and were fractionally distilled and fractionally crystallized. The experimental procedure is described and the molar refractivities, calculated from data taken at 30°C., of all seven ketones is reported.

The reaction rates for these ketones and hydroxylamine hydrochloride at 0.05M concentration were determined at 30.0°, 35.0° and 40.0°C. The temperatures were kept constant within ±0.1°C. The method of analysis for unreacted hydroxylamine, based on the method devised by Ölander, is described in detail. The per cent reaction at different time intervals is listed. The data are plotted for a representative run of each ketone at the three different temperatures and is shown to fit the second order rate equation. The slope of the best straight line for each run has been

Rate Constants for Oximation of n-Alkyl Phenyl Ketones
(k is expressed in liters per mol per second)

Ketone	$k_{30.0}$	$k_{35.0}$	$k_{40.0}$
Acetophenone	0.0243	0.0267	0.0493
Propiophenone	0.0141	0.0184	0.0303
Butyrophenone	0.0106	0.0148	0.0215
Valerophenone	0.0117	0.0167	0.0228
Caprophenone	0.0107	0.0167	0.0215
Enanthophenone	0.0125	0.0182	0.0239
Caprylophenone	0.0115	0.0177	0.0222

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calculated by the method of least squares and is recorded. The rates reported at the three temperatures are listed in the table on the preceding page.

The rate data obtained were used to calculate energy quantities by substitution in the Arrhenius equation. The following table shows the values obtained from these calculations.

Ketone	ΔE_a kcal.	log PZ	$k_{calc.}$	$k_{obs.}$
Acetophenone	13.37	8.03	0.0349	0.0267
Propiophenone	14.46	8.58	0.0208	0.0184
Butyrophenone	13.37	7.67	0.0151	0.0148
Valerophenone	12.61	7.16	0.0164	0.0167
Caprophenone	13.20	7.54	0.0153	0.0167
Enanthophenone	12.25	6.93	0.0174	0.0182
Caprylophenone	12.43	7.03	0.0161	0.0177

PART II

Aminoethers

The program of rate studies on oximation made available three series of alkyl aryl carbinols. It was noted that these carbinols had a structural similarity to the well known carbinol benzhydrol which is used as a starting point for synthesis of the antihistaminic agent Benadryl. It was noted further that in sympathomometic drugs if a phenyl group is replaced by a straight chain aliphatic group the activity of the resulting compound is lowered but the effect is long lasting. A good example of this is found by comparison of the structure and properties of benzidrene and Tuamine.

It was decided to treat the available carbinols with beta-diethylaminoethyl chloride and convert the resulting aminoethers to their hydrochlorides. It is planned to have these aminoether hydrochlorides screened for antihistaminic activity. The compounds made have not been screened as yet and consequently nothing is known of their value as antihistaminic agents.

The p-xylyl carbinol series was furnished by Lester and Suratt. The phenyl carbinol series and the carvacryl carbinol series were made by reduction of the corresponding ketones with aluminum isopropoxide. The sodium salts of all three series of the carbinols were made by treatment of the carbinols in dry toluene with two equivalents of sodamide. The addition of beta-diethylaminoethyl chloride hydrochloride used the extra equivalent of sodamide to free the chloramine and allow a Williamson type ether synthesis to occur. This method of synthesis was chosen in order to avoid the isolation of the free chloroamine which is known to have a tendency to form a cyclic compound with another molecule of chloroamine. The aminoethers made in this manner were distilled through a straight condenser and the distilled aminoethers were converted to their hydrochlorides. These hydrochlorides were made by treatment of the aminoethers with a saturated solution of dry hydrogen chloride in dry diisopropyl ether. The precipitated aminoether hydrochlorides were filtered, dried and analyzed by a modified Mohr chloride analysis which is described in detail. The analytical results of these compounds agreed favorably with the theoretical chlorine content of the compounds desired.

Microfilm $2.00; Xerox $5.00. 97 pages.

KINETICS OF THE ACID-CATALYZED REARRANGEMENT OF THE sym- AND unsym-DI-p-METHOXY DERIVATIVES OF BENZOPINACOL AND TETRAPHENYLETHYLENE OXIDE

(L. C. Card No. Mic 59-916)

Sister Mary Dismas Rehfuss, C.S.J., Ph.D.
St. Louis University, 1958

The kinetics and mechanism of the perchloric acid-catalyzed rearrangement in aqueous acetic acid of 1,2-bis(p-methoxyphenyl)-1,2-diphenylethylene glycol (I), 1,2-bis(p-methoxyphenyl)-1,2-diphenylethylene oxide (II), 1,1-bis(p-methoxyphenyl)-2,2-diphenylethylene glycol (III) and 1,1-bis(p-methoxyphenyl)-2,2-diphenylethylene oxide (IV) have been the subject of this investigation. The reaction mixtures were analyzed for pinacol content by oxidation with lead tetraacetate and for the pinacolones by a spectrophotometric method.

In the case of each of the four compounds it was shown that changes in specific rate produced by changes in the water content of the solvent or in the concentration of the perchloric acid catalyst are quantitatively accounted for by the corresponding changes in acidity of the reaction medium as measured by the Hammett H_o acidity function scale. The correlation of log specific rate with H_o is consistent with the assumption that the rate-determining step is the conversion of a protonated substrate ion to a carbonium ion.

It has been shown that the symmetrical pinacol I is converted entirely to the pinacolone without detectable formation of the ethylene oxide as a reaction intermediate. The absence of ring-closure in this case has been interpreted as arising from the availability of an anisyl group of high intrinsic migratory tendency on the carbon atom adjacent to the electron-deficient carbon of the carbonium ion. The symmetrical oxide undergoes rearrangement eight times faster than the glycol. This difference in rate is understandable since the formation of the carbonium ion from the oxonium ion of the oxide is accompanied by a relief of bond-angle strain present in the oxirane ring and probably by a relief of compression strain arising from the four cis-oriented aryl groups.

The unsymmetrical pinacol III, on the other hand, is converted entirely to the ethylene oxide before any experimentally determinable pinacolone is formed. The ethylene oxide rearrangement rate is approximately 150 times slower than the rate of oxide formation from the pinacol. The pinacolone mixture obtained is 80% of ketone A formed by phenyl migration and 20% of ketone B formed by anisyl migration. From the results of a kinetic investigation of 1,1,2,2-tetraphenylethanol and its di-p-methoxy derivatives, it was shown that carbonium ion formation on carbon-1 in the unsymmetrical pinacol should be faster in a ratio of 1000:1 relative to the rate of ionization at carbon-2. The unexpected migration ratios and the anomalously slow epoxide rearrangement are the direct result of the rapid reversible formation of the ethylene oxide from the rapidly generated carbonium ion. Although the rate of carbonium ion formation at carbon-1 is high relative to that at carbon-2 due to the electron-releasing p-methoxy substituents, the former ion is very inefficiently converted to the pinacolone because of the competing ring closure reaction.

The kinetic results are consistent with the following mechanism, in which P represents the unsymmetrical

pinacol, E represents the corresponding oxide and R_1^+ and R_2^+ the carbonium ions formed at carbon-1 and carbon-2 respectively:

(1) $P + H^+ \rightleftharpoons PH^+$ (equilibrium)
(2) $E + H^+ \rightleftharpoons EH^+$ (equilibrium)
(3) $PH^+ \rightarrow R_1^+ + H_2O$ (slow)
(4) $PH^+ \rightarrow R_2^+ + H_2O$ (very slow)
(5) $R_1^+ \rightarrow EH^+$ (fast)
(6) $EH^+ \rightarrow R_1^+$ (slow)
(7) $EH^+ \rightarrow R_2^+$ (very slow)
(8) $R_1^+ \rightarrow$ Pinacolone A $+ H^+$ (fast; slow relative to 5)
(9) $R_2^+ \rightarrow$ Pinacolone B $+ H^+$ (fast)

Microfilm $2.00; Xerox $6.60. 137 pages.

PART I: SOME REACTIONS OF EUCARVONE AND ITS DERIVATIVES. PART II: RING-BRIDGING REACTIONS OF CERTAIN CYCLOHEXANONES.

(L. C. Card No. Mic 59-566)

William Alan Remers, Ph.D.
University of Illinois, 1958

PART I

Steric hinderance by the neighboring gem-dimethyl groups strongly inhibits substitution at the methylene group adjacent to the carbonyl of eucarvone, γ,δ-dihydroeucarvone and tetrahydroeucarvone. Although this causes bridging reactions with eucarvone, the latter two compounds fail to form bicyclic systems. In addition to anionic bridging reactions, eucarvone also appears to give free radical bridging reactions.

Cycloheptatriene compounds derived from eucarvone have been found to be stable in the monocyclic form rather than as their bicycloheptadiene valence tautomers.

PART II

The type of bicyclic compound formed by the bridging of a cyclohexanone derivative depends on the structure of the cyclohexanone derivative and the experimental conditions. Examples of the bicyclo-(2.2.2) octanone and the bicyclo-(4.2.0) octanone ring systems were prepared and, in addition, a compound appearing to have a cyclic ether ring was formed.

Irradiation of 2-cyclohexenone produced a compound which appeared to be either a dimer with a diphenylene structure or a trimer with a triphenylene structure.

Microfilm $2.00; Xerox $4.00. 74 pages.

I. THE SYNTHESIS OF CERTAIN OCTA- AND DECA-HYDROISOQUINOLINES; II. THE REACTION OF CERTAIN 1-ACYL-3-SUBSTITUTED-4-PIPERIDONES WITH ORGANOMETALLIC REAGENTS.

(L. C. Card No. Mic 59-1180)

David Carroll Remy, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Samuel M. McElvain

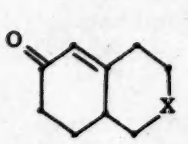
The cuprous chloride promoted 1,4 addition of phenylmagnesium bromide to the unsaturated ketone I gave a 66% yield of the diene II and a 25% yield of the ketone III. Wolff-Kishner reduction of the carbonyl group of III gave the hydrocarbon IV. A tentative assignment of cis ring fusion has been made to III and IV.

When the unsaturated ketone V was allowed to react with phenylmagnesium bromide in the presence of cuprous chloride a 60% yield of the diene VI was obtained together with a 17% recovery of V.

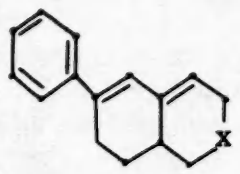
The hydrogenation of V gave equal amounts of the cis and trans ketones, VII and VIII, respectively.

The ketones IX and X have abnormal ultraviolet absorption spectra in that a hypsochromic shift of the wavelength of maximum absorption was observed. The use of the iodide salt XI rather than the perchlorate salt X leads to a spurious value of this hypsochromic shift. The ultraviolet absorption maxima of I, IX, and X in various solvents were found to be linear with respect to Z, a new standard of solvent polarity. The ultraviolet absorption maxima of V in solvents of widely different polarity were found to be almost constant, however, and a rationalization of this observation has been suggested.

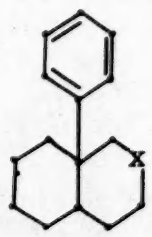
The synthesis of XII was undertaken in order to study the possible Claisen rearrangement of this ether.



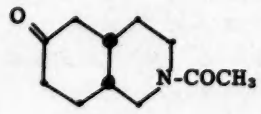
I, X = CH_2
V, X = $NCOCH_3$
IX, X = NCH_3
X, X = $^+N(CH_3)_2ClO_4^-$
XI, X = $^+N(CH_3)_2I^-$



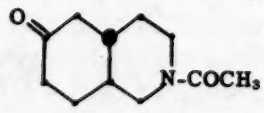
II, X = CH_2
VI, X = $NCOCH_3$



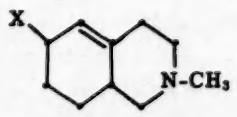
III, X = CO
IV, X = CH_2



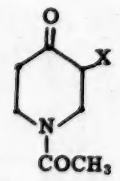
VII



VIII



XII, X = OC_6H_5
XIII, X = OH
XIV, X = Cl
XV, X = o-HO-C_6H_4



XVI, X = H
XVII, X = $(CH_2)_3CH_3$
XVIII, X = $CH_2C_6H_5$

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Reduction of IX gave an 88% yield of XIII which on treatment with hydrogen chloride gave a 77% yield of the hydrochloride of XIV. Attempts to prepare the ether XII from the hydrochloride of XIV were unsuccessful due to self-quaternization of the free base XIV. The reaction of the hydrochloride of XIV with phenol gave an 86% yield of XV.

The non-basic piperidones XVI, XVII, and XVIII were prepared in order to study their reactions with phenyllithium and phenylmagnesium bromide. In each reaction a low yield of the addition compound and a high yield of recovered ketone was obtained. These results are opposite to those predicted from a previous suggestion that the basic nitrogen atom of certain 1-methyl-3-substituted-4-piperidones was responsible for the large amounts of enolization observed when these compounds were allowed to react with organometallic compounds.

Microfilm $2.00; Xerox $5.40. 107 pages.

THE REACTIONS OF exo-CYCLIC VINYL HALIDES WITH PHENYLLITHIUM AND n-BUTYLLITHIUM

(L. C. Card No. Mic 59-567)

William Harry Richardson, Ph.D.
University of Illinois, 1958

9-Bromomethylenefluorene was allowed to react with phenyllithium and 1,4-dibiphenylenebutatriene was formed in nearly a quantitative yield, based on recovered 9-bromomethylenefluorene. In the corresponding reaction with 9-chloromethylenefluorene, 1,4-dibiphenylenebutatriene was obtained in 18% yield along with 9-benzylidenefluorene in 19% yield. The formation of 1,4-dibiphenylenebutatriene was explained by the dimerization of two carbene intermediates. The formation of 9-benzylidenefluorene may also be explained by a carbene mechanism. However, the evidence for a carbene intermediate is not complete.

The reactions of n-butyllithium with 9-bromo- and 9-chloromethylenefluorene are to be contrasted with the reactions of phenyllithium with these halides. The reaction of 9-bromomethylenefluorene with n-butyllithium gave 1,4-dibiphenylenebutadiene in 38% yield along with 1,4-dibiphenylene-2, 4-dibutyl-1-butene in 3% yield. In the reaction of 9-chloromethylenefluorene with n-butyllithium, 1,4-dibiphenylene-3,4-dibutyl-1-butene was obtained in 46% yield along with 9-pentylidenefluorene in 7% yield. The formation of 1,4-dibiphenylenebutadiene is proposed to occur by a displacement of a vinyl lithium intermediate on the starting 9-halomethylenefluorene. A mechanism, is proposed for the formation of 1,4-dibiphenylene-3,4-butyl-1-butene in which n-butyllithium adds to 1,4-dibiphenylenebutadiene followed by displacement on n-butyl chloride. The formation of 9-pentylidenefluorene was proposed to occur by a displacement reaction of n-butyllithium on 9-chloromethylenefluorene.

In none of the above reactions was there evidence for rearrangement to a phenanthrene system.

The reaction of phenyllithium with 9-chloromethylene-9,10-dihydro-10,10-di-n-propylanthracene gave the cumulene, di(9,10-dihydro-10,10-di-n-propyl-9-anthracenylidene)-ethylene in 15% yield. In addition, a 19% yield of 9-benzylidene-9,10-dihydro-10,10-di-n-propylanthracene was obtained. A carbene mechanism was proposed for the formation of these products.

Rearrangement was realized in the reaction of phenyllithium with 1-chloromethylene-2,3,6,7-dibenz-2,6-cycloheptadiene. A 23% yield of 1-phenyl-2,3,6,7-dibenz-2,6,8-cyclooctatriene was obtained. A 3,4,7,8-dibenzcyclooctа-3,7-dien-1-yne intermediate was proposed.

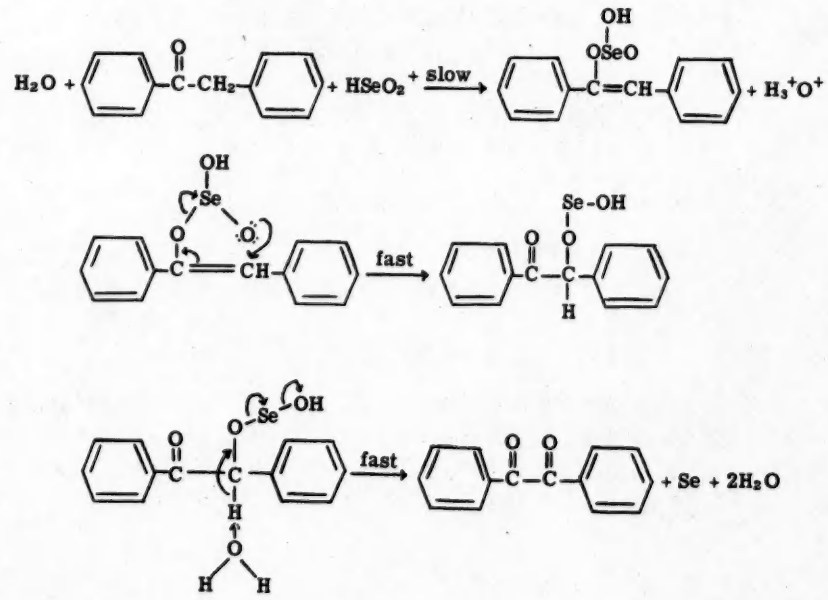
Microfilm $2.60; Xerox $9.00. 200 pages.

MECHANISM STUDIES ON THE SELENIUM DIOXIDE OXIDATION OF KETONES

(L. C. Card No. Mic 59-571)

John Paul Schaefer, Ph.D.
University of Illinois, 1958

It has been shown that the selenium dioxide oxidation of ketones is second order: first order in the ketone and first order in selenium dioxide. The reaction is catalyzed by acids and the rate of oxidation has been shown to depend linearly upon the concentration of added acid. A small salt effect has been observed along with a deuterium isotope effect (k_H/k_D) of 6. It has been demonstrated that the enol is not involved in the sequence of steps leading to oxidation. The following mechanism has been formulated:



It has been found that when electron withdrawing groups are present in the ring adjacent to the carbonyl ring, the reaction is slowed down, whereas if they are contained in the benzyl ring, the reaction rate is accelerated, the nitroketone being anomalous. Steric hindrance of the carbonyl group has little, if any, effect upon the reaction rate, but steric hindrance of the methylene group reduced the reaction rate sharply. These results are consistent with the proposed mechanism.

When sodium acetate was added to the reaction mixture the rate of reaction was accelerated; a maximum was reached when the concentration of sodium acetate equaled that of selenium dioxide. It was found that the effect of substituents was reversed from the order previously observed. Moreover, the greater the steric hindrance about the carbonyl group, the faster the oxidation proceeded.

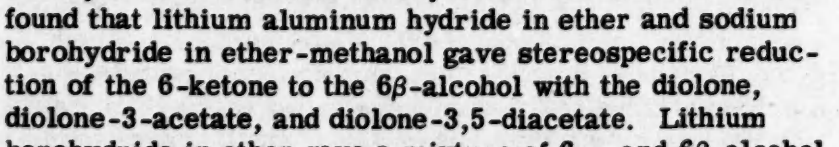
Steric hindrance of the methylene group again slowed down the rate of oxidation. A deuterium isotope effect (k_H/k_D) of 7.6 was observed but this decreased as the reaction proceeded due to exchange of the deuterium with the solvent.

A mechanism which is consistent with the data is suggested.

$$H_2SeO_3 + NaOAc \underset{\text{fast}}{\overset{\text{fast}}{\rightleftharpoons}} NaHSeO_3 + HOAc$$

or

$$SeO_2 + OAc^- \underset{\text{fast}}{\overset{\text{fast}}{\rightleftharpoons}} SeO_2OAc^-$$



This enol-ester would then decompose in the manner previously indicated.

A new application of the selenium dioxide oxidation has been found in synthesizing α-keto esters from α-halo ketones. An improved procedure for the synthesis of bicyclo-[2.2.2]-octanone has been developed.

Microfilm $2.00; Xerox $3.60. 61 pages.

PART I. THE STRUCTURE OF URBANINOL. PART II. STUDIES ON THE SINGLE-STEP CONVERSION OF 3-β-HYDROXY-(A/B TRANS)-STEROIDS TO 3-α-HYDROXY-(A/B CIS)-STEROIDS AS A METHOD FOR ELABORATING THE A/B SYSTEM OF BILE ACIDS.

(L. C. Card No. Mic 59-573)

Robert George Schultz, Ph.D.
University of Illinois, 1958

PART I

It has been shown from some further structural studies and from theoretical considerations that the structure of urbaninol is probably a taraxerene skeleton with an additional 11,26 ether bridge.

PART II

The reductions of cholestan-3β,5α-diol-6-one, cholestan-3β,5α-diol-6-one-3-acetate, cholestan-3β,5α-diol-6-one-3,5-diacetate and cholestan-3β,5α-diol-6-one-3-tosylate-5-acetate with lithium aluminum hydride, lithium borohydride and sodium borohydride were studied. It was found that lithium aluminum hydride in ether and sodium borohydride in ether-methanol gave stereospecific reduction of the 6-ketone to the 6β-alcohol with the diolone, diolone-3-acetate, and diolone-3,5-diacetate. Lithium borohydride in ether gave a mixture of 6α- and 6β-alcohol with cholestan-3β,5α-diol-6-one-3-acetate and gave stereospecific reduction to the 6α-alcohol with concomitant rearrangement of the acetyl moiety to the 6α-acetate with cholestan-3β,5α-diol-6-one-3,5-diacetate and cholestan-3β,5α-diol-6-one-3-tosylate-5-acetate. Sodium borohydride reduction of cholestan-3β,5α-diol-6-one-3-tosylate-5-acetate afforded a 5 $\rightarrow$ 3 displacement of tosylate by acetate with introduction of a 3α-hydroxyl group and retention of the 5α-acetate.

Several other 5 $\rightarrow$ 3 displacements and rearrangements were studied. Cholestan-3β,5α-diol-6-one-3-tosylate-5-acetate was found to give cholestan-3α,5α-diol-6-one-3-acetate when treated with dimethyl formamide, water and potassium acetate, and cholestan-3α,5α-diol-6-one-5-acetate when treated with dimethyl formamide and water. The 5-acetate could be rearranged to the 3-acetate with dimethyl formamide, water and potassium acetate.

Reaction of cholestan-3β,5α,6α-triol-3-tosylate-6-methyl ether with acetyl chloride and N,N-diethyl aniline was found to yield a Δ^5-enol ether by trans elimination of the 6β-hydrogen.

Microfilm $2.00; Xerox $4.80. 92 pages.

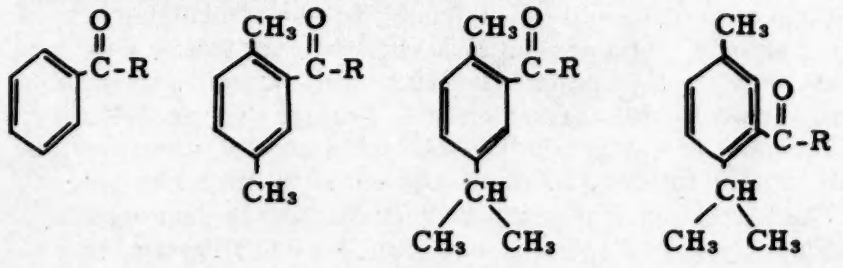
A STUDY OF THE OXIME FORMATION OF A SERIES OF ALKYL-ARYL KETONES

(L. C. Card No. Mic 58-5184)

Edgar Cecil Suratt, Jr., Ph.D.
Emory University, 1950

The reaction between a carbonyl compound and hydroxylamine to form an oxime has been known since 1882 and has been extensively investigated kinetically. The reaction proceeds by a second-order reversible mechanism and has been shown to be both specific and general acid catalyzed. In early studies this catalysis was not realized; thus, many erroneous conclusions were drawn as to the effect of molecular structure on the reactivity of the carbonyl group. Westheimer determined the rate of semicarbazone formation under different conditions of acidity and in different solvents. It was found that the rate constants vary considerably with a change in medium. It was also discovered that the relative order of reactivity within the series also changes. For example, in one medium ortho nitrobenzaldehyde reacts faster than acetone while under different conditions the reverse is true. Since the rate of reaction depends upon the degree of polarization of the carbonyl group, different media would be expected to have such an effect on compounds differing greatly in electronic nature.

It was our belief, however, that within a group of compounds which do not differ greatly from each other this large variation would not be observed.



I Phenyl — II p-Xylyl — III Carvacryl — IV Thymyl

Compounds in this series, with the exception of (I), differ from each other only in the position of substituted alkyl groups. R varies from methyl through heptyl. Variations

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in solvent and buffer should not affect the relative reactivity greatly within the series as there are no strongly polar groups present. In addition, (II), (III) and (IV) have the resonance stabilizing influence of an ortho alkyl group. The greatest variation would be expected with (I), since no such stabilizing influence is present.

Table I shows the relative rates in the various media studied.

Table I

Effect of Medium on Relative Rates
30°

Ketone	A	B[a]	C	D
Phenyl				
methyl	143	---	84.0	---
ethyl	84.4	89.6	67.9	---
n-propyl	61.8	65.5	56.0	45.7
p-Xylyl				
methyl	10.7	14.5	10.4	---
ethyl	5.02	5.20	4.78	---
n-propyl	3.37	3.45	3.17	3.95
Carvacryl				
methyl	10.6	---	10.4	---
n-propyl	2.95	2.78	3.00	3.10
Thymyl				
methyl	5.97	5.36	---	---
ethyl	1.35	1.44	1.29	---
n-propyl	1.00	1.00	1.00	1.00

Medium A: Absolute methanol; pyridine buffer.
Medium B: 75 per cent ethanol; pyridine buffer.
Medium C: 75 per cent ethanol; acetate buffer.
Medium D: 75 per cent cellosolve; acetate buffer.

[a]Craft, Mary Jean, Dissertation, Emory University, 1950.

Table II

Oxime Formation in Absolute Methanol

Ketone	k x 10^{-4}		
	30°C.	35°C.	40°C.
Phenyl			
isopropyl	21.6	31.5	42.1
p-Xylyl			
methyl	18.4	31.0	40.3
ethyl	8.63	11.0	16.2
n-propyl	5.79	7.92	12.0
n-butyl	5.23	8.78	11.9
isobutyl	.852	1.24	1.53
amyl	5.66	8.47	11.5
hexyl	5.58	8.46	11.7
heptyl	5.52	8.50	11.5

A number of related compounds were studied in a solvent not previously described in the literature, absolute methanol with a pyridine buffer. These appear in Table II.

The effect of a para alkyl substituent was also studied in absolute methanol. Table III indicates that the electronic influences of the methyl, ethyl, isopropyl and t-butyl groups are of approximately the same magnitude in this reaction. All decrease the reactivity of the carbonyl group about 30 per cent.

Table III

Rate of Oximation of p-Substituted Phenyl Ketones

Ketone	k x 10^4	
	30°C.	40°C.
p-methyl acetophenone	162	262
p-ethyl acetophenone	165	277
p-isopropyl acetophenone	167	299
p-t-butyl acetophenone	167	304
p-methyl propiophenone	99.0	175
p-ethyl propiophenone	98.0	171
p-isopropyl propiophenone	103	174
p-t-butyl propiophenone	100	179

This study has shown that approximate numerical values can be assigned to the compounds studied, regardless of the medium in which the reaction occurs. Although no attempt has been made to make the determinations under conditions of maximum reactivity, it is believed that no significant changes would be observed under these conditions. Microfilm $2.00; Xerox $6.00. 125 pages.

SYNTHESIS OF 7-(DIALKYLAMINOALKYL)-BENZO[c]PHENOTHIAZINES; THE METALATION OF 7H-BENZO[c]PHENOTHIAZINE WITH n-BUTYLLITHIUM

(L. C. Card No. Mic 59-1476)

William Earl Tatum, Ph.D.
The University of Tennessee, 1958

Major Professor: D. A. Shirley

In view of the pharmacological importance of phenothiazine and its derivatives, this investigation was undertaken to synthesize a series of 7-(dialkylaminoalkyl)-benzo[c]-phenothiazines, compounds structurally related to the more important phenothiazine types. In connection with preparation of these compounds, the metalation of 7H-benzo[c]-phenothiazine was studied in an effort to find a synthetic route for introduction of substituents into a position of the benzophenothiazine nucleus not readily accessible by other preparative techniques. Metalation of this compound was found to occur in the 6-position in yields up to 41 per cent.

The following compounds which were prepared during the course of this work, have not been previously reported:

10-Methoxy-7H-benzo[c]phenothiazine

10-Methoxy-7-(3-dimethylaminopropyl)-benzo[c]phenothiazine

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

7-(2-Dimethylaminoethyl)-benzo[c]phenothiazine
7-(2-Dimethylaminoethyl)-benzo[c]phenothiazine methiodide
7-(2-Dimethylaminoethyl)-benzo[c]phenothiazine picrate
7-(3-Dimethylaminopropyl)-benzo[c]phenothiazine
7-(3-Dimethylaminopropyl)-benzo[c]phenothiazine methiodide
7-(3-Dimethylaminopropyl)-benzo[c]phenothiazine picrate
7-(2-Diethylaminoethyl)-benzo[c]phenothiazine
7-(2-Diethylaminoethyl)-benzo[c]phenothiazine picrate
10-Methyl-7-(3-dimethylaminopropyl)-benzo[c]phenothiazine
10-Methyl-7-(3-dimethylaminopropyl)-benzo[c]phenothiazine methiodide
8,11-Dimethyl-7-(3-dimethylaminopropyl)-benzo[c]-phenothiazine
8,11-Dimethyl-7-(3-dimethylaminopropyl)-benzo[c]-phenothiazine methiodide
9-Chloro-7-(3-dimethylaminopropyl)-benzo[c]phenothiazine
9-Chloro-7-(3-dimethylaminopropyl)-benzo[c]phenothiazine methiodide
6-Carboxy-7H-benzo[c]phenothiazine
6-Carbomethoxy-7H-benzo[c]phenothiazine

Pharmacological evaluation of the compounds prepared during this research is being conducted by the Eli Lilly Company and the National Cancer Institute.

Microfilm $2.00; Xerox $5.00. 100 pages.

STUDIES ON THE MECHANISM OF THE BASE-CATALYZED SOLVOLYSIS OF TRIORGANOSILANES

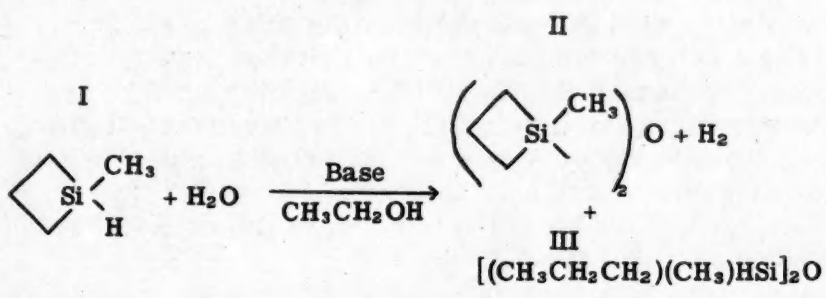
(L. C. Card No. Mic 59-782)

Donald Richard Weyenberg, Ph.D.
The Pennsylvania State University, 1958

A quite general reaction of triorganosilanes is base-catalyzed solvolysis to yield hydrogen and a triorganosilanol or its condensation product, a disiloxane. Previous studies of the kinetics, the structure-reactivity relationships, and the deuterium isotope effects on this reaction were unable to rigorously distinguish between a mechanism involving simultaneous attack of the base at the silicon and acceptance of the ejected hydride ion by a solvent molecule and a mechanism involving a reactive pentacovalent silicon intermediate formed from the base and the silane.

1-Methyl-1-silacyclobutane was known to undergo base-catalyzed solvolysis much more rapidly than the corresponding noncyclic silanes to give products arising from the cleavage of the silacyclobutyl ring in addition to the expected solvolysis products. As the presence of this side reaction offered some unique possibilities for differentiating between certain of the above mechanisms, the kinetics and deuterium isotope effects on this reaction were investigated.

This solvolysis reaction proceeded via the following path with ethanolic amine buffers. The kinetics and the product ratio, II/III, were obtained by following the hydrogen evolution. The following rate law was observed with 95% ethanolic buffer solutions prepared from ammonia,



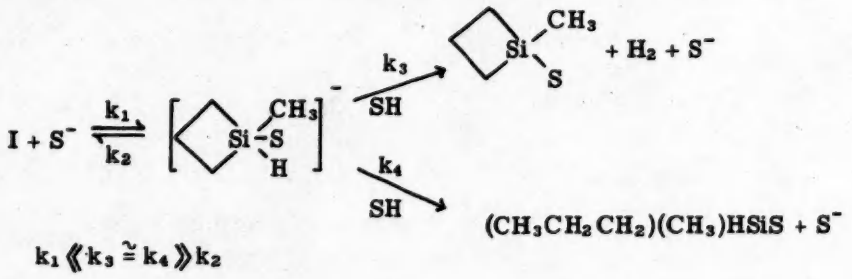
ethylamine, diethylamine, triethylamine, piperidine, and t-butylamine.

$$\frac{-d(\ln[I])}{dt} = k_{2(S^-)}[S^-] + k_{2(B)}[B]$$

B ≡ Amine S^- ≡ OH^- or $CH_3CH_2O^-$

Each catalytic species gave a specific ratio of products.

A study of the solvolysis of 1-methyl-1-silacyclobutane-1-d with the diethylamine and triethylamine buffers gave the isotope effects on both the rate of disappearance of I and on the product ratio. These isotope effects for the lyate-ion-catalyzed reaction, $k_2^H{}_{(S^-)}/k_2^D{}_{(S^-)}$ and $(II/III)^H/(II/III)^D$, were 1.12 and 1.9 respectively. This small isotope effect on the reaction rate and larger isotope effect on the product ratio could only be explained by a rate-determining formation of a pentacovalent silicon intermediate from the base and silane. This intermediate may then decompose by cleavage of either the silicon-hydrogen or the silicon-carbon bond to yield ethoxysilanes or silanols which would be rapidly converted into products II and III. The similarity of these isotopic rate ratios to



those reported for other trialkylsilanes indicates that the general mechanism for the base-catalyzed solvolysis of triorganosilanes involves a rate-determining formation of a reactive pentacovalent silicon intermediate from the silane and the base.

The relative $k_{2(B)}$'s for the series of amines and the small $k_2^H{}_{(B)}/k_2^D{}_{(B)}$ ratio, 1.10 to 1.13, were consistent with a mechanism for the amine-catalyzed solvolysis reaction involving a rate-determining formation of a pentacovalent silicon intermediate from the amine, the silane, and a solvent molecule.

Microfilm $2.00; Xerox $6.80. 142 pages.

KINETICS AND MECHANISM OF THE PERCHLORIC ACID-CATALYZED REARRANGEMENT OF cis- AND trans-9,10-DIPHENYL-9,10-DIHYDROPHENANTHRENE-9,10-DIOL IN ACETIC ACID SOLUTION

(L. C. Card No. Mic 59-922)

Hsien-Cheng Yao, Ph.D.
St. Louis University, 1958

This investigation concerned the reaction kinetics of the perchloric acid-catalyzed rearrangement of cis- and trans-9,10-diphenyl-9,10-dihydrophenanthrene-9,10-diol in aqueous acetic acid solution. The rearrangement product, 10,10-diphenyl-9,10-dihydro-9-phenanthrone, was determined by a spectrophotometric method. The cis- and trans-pinacol components of the reaction mixture were determined by a differential kinetic method involving oxidation by lead tetraacetate. The experimental results show the following features of the rearrangement reactions:

(1) Both the cis- and the trans-pinacol appear to rearrange by a kinetically simple path. There is no evidence of cis-trans isomerization during the course of either rearrangement.

(2) There is no evidence that the epoxide of 9,10-diphenylphenanthrene is involved as a reaction intermediate of kinetic significance in the rearrangement of either the trans- or the cis-pinacol.

(3) The reactivity of the cis-pinacol is much greater than that of the trans-pinacol, the ratio of rates at 30° being 603.

(4) A linear correlation between the logarithms of the rates of rearrangement and the values of Hammett acidity function of the solution was observed for both pinacols.

Typical values of the rate coefficients and of the activation thermodynamic quantities are presented in the table. A comparison of these values with those of benzopinacol

Table

Rearrangement of cis- and trans-9,10-Diphenyl-9,10-dihydrophenanthrene-9,10-diol in Acetic Acid Containing 1.6% by weight of Water

	Temp., °C	Specific Rate, 1./(mole-sec.)	E_a, kcal./mole	$\Delta S^{\ddagger}$, e.u.	$\Delta F^{\ddagger}$, kcal./mole
cis-Pinacol	30	0.206	25.0 ± 0.4	18.9 ± 1.3	18.5 ± 0.2
trans-Pinacol	30	3.42×10^{-4}	27.65 ± 0.56	14.8 ± 1.7	22.4 ± 0.7

suggests that the observed reactivity ratio reflects an abnormally high reactivity of the cis-pinacol rather than an abnormally low reactivity of the trans-pinacol. This difference in reactivity can be attributed to differences in molecular conformation of the two isomers. Three such conformational effects are considered to be of significance: (1) internal hydrogen bonding involving the hydroxyl group of the cis-pinacol which stabilizes the oxonium ion (and transition state complex) relative to the neutral glycol; (2) steric interaction involving the 9,10-phenyl groups which is relieved in the planar carbonium ion; (3) equatorial positioning of one of the phenyl groups of the cis-isomer close to its required position in the carbonium ion. The first two of these effects could account for the lower activation energy of the cis-pinacol relative to the trans-pinacol while the latter effect rationalizes the difference in activation entropy.

The acidity function-rate correlation is consistent with the mechanism in which a reversible proton transfer to glycol hydroxyl group is followed by a rate-determining dissociation to form a water molecule and a carbonium ion. The two pinacols would be expected to yield the same car-

$$\text{(1a) cis-ROH} + H^+ \underset{}{\overset{K_C}{\rightleftharpoons}} \text{cis-ROH}_2^+ \quad \text{(fast)}$$

$$\text{(1b) trans-ROH} + H^+ \overset{K_T}{\rightleftharpoons} \text{trans-ROH}_2^+ \quad \text{(fast)}$$

$$\text{(2a) cis-ROH}_2^+ \xrightarrow{k_C} R^+ + H_2O$$

$$\text{(2b) trans-ROH}_2^+ \xrightarrow{k_T} R^+ + H_2O \quad \text{(slow and essentially irreversible)}$$

$$\text{(3)} \quad R^+ \longrightarrow R'^+ \longrightarrow \text{Pinacolone} + H^+$$

bonium ion R^+, although at different rates, if the mechanism is assumed to be of the limiting carbonium ion type. The carbonium ion R^+ undergoes rearrangement to R'^+ without detectable competition from either of the possible diversionary process of epoxide formation or reaction with water or other solvent molecules.

Microfilm $2.00; Xerox $5.80. 119 pages.

CHEMISTRY, PHARMACEUTICAL

A STUDY OF PERMEABILITY TO WATER VAPOUR OF FATS, WAXES AND OTHER ENTERIC COATING MATERIALS AND THEIR COEFFICIENT OF THERMAL EXPANSION

(L. C. Card No. Mic 59-1379)

Armando Joseph Aguiar, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Takeru Higuchi

The present investigations were concerned with two physical properties of solid phases commonly employed as coating materials for several pharmaceutical dosage forms. In the first part of the study the rate of permeation of various barrier materials by water vapour was investigated experimentally from both qualitative and quantitative standpoints. The second part was concerned with the magnitude of differential thermal expansion coefficients of some of the same materials from the standpoint of possible physical instability induced by large temperature fluctuations.

The results of permeability measurements on a number of polymeric and waxy materials to water vapour as determined in a diffusion cell are shown in Table I, expressed in terms of permeability and diffusion constants. The latter values were calculated from lag time data and are strictly valid only if Fick's second law held for these systems. Studies on glyceryl monostearate made as a part of the present investigation show, however, that experimental values of both permeability and diffusion constants are subject to change with the concentration of water vapour on the high pressure side. This strongly suggests that for these systems true diffusion coefficients cannot be calculated by way of lag time. These data are nevertheless of practical importance in giving the effective rate of

TABLE I

Permeability and Diffusion Coefficients of Compounds at 24.5°C and 100% Humidity

Compound	$D^a \times 10^8$	$P^b \times 10^8$
Cellulose acetate hydrogen phthalate	62	325
Cellulose triacetate	53.6	133
Cellulose acetate propionate	36.7	108
Cellulose acetate butyrate	25.7	42
Cellulose acetate stearate	8.5	10.5
Saran a	0.21	0.05
Koroseal	0.12	7.7
Polytrifluorochloroethylene	0.02	0.006
Glyceryl monostearate	194	12.9
Glyceryl distearate	204	3.21
Glyceryl tristearate	13	1.54

[a]Permeability in c.c./cm²/sec/cm Hg/cm thick
[b]Diffusion in cm²/sec

moisture penetration of drugs coated with such materials.

Based on temperature dependence studies and use of Arrhenius type equation the activation energies for permeation and diffusion through a glyceryl monostearate barrier were calculated. These were found to be 7700 cal/mole and 16400 cal/mole respectively. The effect on permeability and diffusion coefficients on addition of varying concentrations of White Wax to glyceryl stearates were also studied. The results suggested possible formation of two immiscible solid phases with glyceryl monostearate. Both distearate and tristearate apparently formed homogeneous systems with the wax.

The coefficient of thermal expansion obtained by dilatometric methods are shown in Table II. Included are also the coefficients obtained of some sugars commonly used as subcoats.

TABLE II

Coefficient of Cubical Expansion of Coating Materials

Material	$C \times 10^4$	Material	$C \times 10^4$
Cellulose acetate stearate	7.2	Glyceryl monostearate	26
Cellulose acetate hydrogen phthalate	5.2	Glyceryl distearate	52
Cellulose acetate butyrate	4.1	Glyceryl tristearate	76
Cellulose acetate propionate	3.8	Mannose	3.5
Cellulose triacetate	3.5	Galactose	3.0
Polytrifluorochloroethylene	6.7	Lactose	2.9
		Dextrose	2.9
		Sucrose	3.5

It is evident from the data that the coefficient of thermal expansion is inversely dependent on the strength of intermolecular bonding, the most polar compound exhibiting the lowest tendency to undergo thermal expansion.

The results obtained are of possible value in selecting the optimum combination of coat and subcoat in tablets or the coat and core in compressed coatings. The materials chosen should have essentially the same coefficients of thermal expansion.

Microfilm $2.00; Xerox $4.60. 89 pages.

TETRIN, A NEW ANTIFUNGAL ANTIBIOTIC

(L. C. Card No. Mic 59-558)

Hugh LeNoir Pote, Ph.D.
University of Illinois, 1958

Tetrin, a new antibiotic, synthesized by a Streptomycete (Ill. #155-2) inhibits filimentous fungi, and yeast but not bacteria. Highest production was after 6 days growth on reciprocal shaker in a medium containing molasses, glucose, peptone and ferric sulfate. Tetrin inhibits Penicillium oxalicum Currie and Thom in an agar dilution test at 20 mcg per ml. The sensitivity of other fungi vary from 3.5 mcg to greater than 200 mcg per ml.

The antibiotic is a tetraene with an ultraviolet absorption at 291, 305, and 319 millimicrons in an aqueous solution. Tetrin is highly soluble in water and the lower alcohols, partially soluble in chloroform, and insoluble in ether, acetone and aliphatic and aromatic hydrocarbons. It is stable under basic and neutral conditions but is unstable in acids. No adsorption takes place on bacteriological sintered glass filters but some loss occurs on passage through Seitz filters. A loss of activity of 20 percent occurs at 100°C for 1 hour. When autoclaved at 121°C for 20 minutes, 55 percent of the activity is lost. Carbon and cation-exchange columns adsorb tetrin. Elution from carbon occurs with ethanol and methyl "Cellosolve," and from the ion-exchange resin with 10 percent sodium chloride.

The compound moves on paper chromatograms only in water miscible solvents. The Rf values in such solvent systems are: water-saturated n-butanol--0.25, n-butanol: acetic acid:water--0.85, n-butanol:pyridine:water--0.64, three percent ammonium chloride--0.53, 50 percent acetone--0.90, benzene:acetic acid:water--0.00, n-butanol: methanol:water--0.64 and benzene, methanol:water--0.00.

Tetrin is not toxic to tomato, soybean, beet, broccoli, radish and pea plants when sprayed on leaves at concentrations as high as 1000 mcg per ml. Similarly treating seeds of lettuce, tomato, bean, pea, radish and melon produced no injury. Applications of the antibiotic to soybean decreased the amount of leaf spot caused by Cercospora sojina Hara. On the other hand, the incidence of asparagus rust caused by Puccinia asparagi DC. was increased by such treatments.

Microfilm $2.00; Xerox $6.00. 123 pages.

STUDIES ON THE DECOMPOSITION OF ISOAMYL NITRITE IN A SEALED SYSTEM

(L. C. Card No. Mic 59-1416)

Dale Henry Szulczewski, Ph.D.
The University of Wisconsin, 1959

Major Professor: Takeru Higuchi

Isoamyl nitrite in sealed glass ampules has been stored and used by the military in this country as an antidote for hydrogen cyanide poisoning and medicinally for cardiac cases. The drug has also seen considerable civilian use for similar purposes. The present study was undertaken, partly under contract with the Armed Service Medical Procurement Agency, to determine the mechanism responsible for the breakdown of this drug on storage and possibly to increase its stability.

The nitrite ester, in its sealed container, has been found to deteriorate slowly producing gaseous by-products which eventually result in explosive rupture of the glass vessel. Rupture of the ampule represents complete loss of the drug. In this investigation an attempt has been made to determine the chemical composition of the gases produced, the nature of the resulting liquid phase and finally, the mechanism or mechanisms responsible for the formation of these products.

Initially, analysis of the gaseous by-products was attempted by means of mass spectrophotometry. Although this yielded some information, the results were not clear because of the innate instability of isoamyl nitrite when subjected to electronic bombardment and the difficulty of separating gases soluble in the ester from the ester itself.

Because of these difficulties, a new analytical procedure was developed suitable for the analysis of mixtures of permanent gases (1). This procedure, based on adsorption vapor phase chromatography at low temperature on a silica gel column showed that the gaseous phase present in ampules of aged isoamyl nitrite contained a mixture consisting principally of elemental nitrogen, nitrous oxide and carbon dioxide with trace amounts of nitric oxide and carbon monoxide. In view of earlier investigations on nitrite ester decomposition the presence of nitrogen was unexpected.

The production of gaseous by-products leads to the development of pressure within the ampule on storage. The rate at which this process takes place was measured as a function of time in an all glass system. By measuring this rate at different temperatures the apparent heat of activation for this process was determined as 20.4 kilo cals./moles. This apparent heat of activation was significantly different from that as found by others for open systems.

Determination of the nature of the liquid products of isoamyl nitrite deterioration was also attempted. Since the degraded liquid was a mixture of substances having similar physical and chemical properties, the conventional analytical approach proved inadequate. Isolation of individual components was finally effected by means of partition vapor phase chromatography. This procedure, used for the separation of various components was supplemented by infra-red spectrophotometry for the purpose of unambiguous identification. By utilizing this procedure the liquid phase present in ampules of aged isoamyl nitrite was found to be a mixture consisting largely of the following substances.

1. Isobutyl nitrite
2. Isoamyl nitrite
3. Isoamyl alcohol
4. Isoamyl formate
5. Isoamyl acetate
6. Isoamyl nitrate
7. Isoamyl isobutyrate
8. Isoamyl isovalerate

There was also some evidence for the presence of free isovaleric, isobutyric and acetic acids.

It was significant that although isovaleraldehyde would be expected as a product of nitrite ester decomposition based on earlier speculations, none actually was observed. The aldehyde test stipulated in the U.S.P. therefore has no significance. Likewise nitric oxide, the major gaseous product expected on the basis of past pyrolysis studies was found in only trace amounts. Results from experiments performed on possible reactions of nitrogen oxides and organic substrate, indicated that nitric oxide in the presence of catalytic quantities of nitrogen dioxide reacts with aldehyde to produce the same gaseous products as found in the case of isoamyl nitrite decomposition.

It is apparent from the above observations that the complete mechanism responsible for breakdown of isoamyl nitrite in a sealed system cannot be written at the present time. Available information, however, indicates initial slow formation of nitric oxide and possibly isovaleraldehyde. Neither products remain as such in the system but react further to form carboxylic acid, water, nitrogen and other products. These reaction products, in turn, lead to formation of isoamyl alcohol, nitric oxide and nitrogen dioxide. Reaction of the nitrogen oxides with the substrate then produces the observed products.

Microfilm $2.00; Xerox $6.00. 122 pages.

CHEMISTRY, PHYSICAL

LIGHT SCATTERING BY SILVER BROMIDE SOLS

(L. C. Card No. Mic 59-1250)

Willard H. Beattie, Ph.D.
University of Minnesota, 1958

Adviser: E. J. Meehan

A review of the light scattering methods to determine particle size is given. Particular attention is given to types of average given by different methods, and the range of size and refractive index over which each is valid. An appendix comparing the notations used by several prominent authors is included.

New calculations of Mie light scattering functions have been made. These are tabulated in chapter III. Scattering coefficients and selected angular scattering functions are given for relative refractive index, m, of 1.75. A set of graphs have been plotted from these and from other tables of light scattering functions to interpolate to intermediate m. From these graphs, various light scattering functions

at intermediate m have been plotted as a function of particle size. The latter graphs are used to determine particle size.

Chapter IV is a critical experimental comparison of the application of various light scattering methods to silver bromide sols. Several light scattering methods were applied to three stable sols. Average particle size and distribution in two of the three sols were measured by electron microscopy, and particle size in one sol was determined by centrifugation. Silver bromide decomposes in the electron beam. Therefore, measurements of particle size were made from replicas, in one of the two sols. Particle size was calculated from light scattering measurements on the basis of monodisperse sols. However, the effect of polydispersity on light scattering was discussed. It was shown that the type of average given by any method depends upon size and refractive index. The type of average was calculated for some of the methods. When light scattering methods giving the same type of average are compared with each other, or with the same type average of the electron microscope size distributions, agreement is better than 10% in most cases.

It was shown that since the difference in wave length exponent at different wave lengths leads to different type averages, this can be used to estimate distribution width. Assuming a log-normal distribution, average size and width were calculated. Agreement with the distribution obtained by electron microscopy was excellent.

Two new absolute analytical methods for concentration determination based on the principles of light scattering have been developed. Both methods have high sensitivity, applicable to concentrations of 10^{-4}-10^{-6}M. Accuracy of 10% may be found in favorable cases, at the concentration of 1 mg. per liter.

Chapter V is a kinetic study of particle formation and growth. Factors found to affect initial particle size were: stirring speed, rate of addition, concentrations, and flocculating electrolytes. Factors which affect growth rate were concentration of silver bromide, concentration of potassium bromide, age of sol, temperature, and presence of flocculating electrolytes, or gelatin. Potentiometric and conductance measurements indicated that precipitation was complete at the end of mixing, but that some of the excess bromide was absent from solution in fresh sols. The loss was attributed to adsorption.

The kinetics of growth were interpreted as a competition between the two mechanisms, coalescence and Ostwald ripening. During and immediately after mixing solutions, particles grew very rapidly. This was attributed to fast flocculation. The growth following this was slow, attributed to Ostwald ripening. It predicts that the rate of ripening depends upon the difference between sizes of particles, their average size, and the solubility product. The temperature dependence of growth was shown to be in agreement with the Ostwald ripening mechanism.

Microfilm $3.00; Xerox $10.40. 232 pages.

INTERACTIONS OF DIFFUSING SPECIES IN POLAROGRAPHIC STUDIES

(L. C. Card No. Mic 59-1214)

Alvin Lester Beilby, Ph.D.
University of Washington, 1958

The boundary value problem, which arises when one species diffusing toward a concentration-polarized electrode reacts with its product formed at the electrode to produce a third species which can also react at the electrode, is solved by the numerical finite difference method. The amount of change in the diffusion charge due to the interaction is determined by comparison with the case where no reaction takes place. The amount of change is dependent upon the diffusion coefficients of the diffusing species and the equilibrium constant for the reaction among the species.

Experimentally observed values for two systems where interaction can take place agree closely with the theoretical values calculated by the numerical method, indicating that the reaction probably does take place in these two cases.

The numerical method could be used for the solution of several other similar systems which involve interaction of the diffusing species.

In the polarographic analysis of multistep reactions at an electrode and of mixtures of species the possibility of interaction among the diffusing species should be considered in interpreting quantitative measurements. However, the success of the polarographic method attests to the fact that the discussed interactions are not very common.

Microfilm $2.00; Xerox $4.40. 81 pages.

THERMODYNAMIC PROPERTIES OF THE SYSTEM $PuCl_3$-KCl

(L. C. Card No. Mic 59-1509)

Robert Benz, Ph.D.
The University of New Mexico, 1958

The molar free energy of formation of plutonium trichloride as a function of temperature (918 to 1067°K) and of composition in liquid $PuCl_3$-KCl solutions was determined from potentiometric measurements made on reversible galvanic cells of the type $Pu_{(l)} \mid PuCl_3\text{-}KCl_{(l)} \mid Cl_{2(g)}$.

The phase diagram of the binary system $PuCl_3$-KCl was determined by the method of thermal analysis. The compound K_3PuCl_6 (melting point, 685 ± 3°K) and a second compound (peritectic point, 611 ± 3°K), possibly K_2PuCl_5, were identified.

The relative partial and relative integral molar quantities (free energy, entropy and enthalpy) of mixing and the corresponding excess quantities of mixing at 973°K and one atmosphere for the binary system $PuCl_3$-KCl and for the binary system K_3PuCl_6-KCl were calculated.

The free energy of formation of pure supercooled liquid plutonium trichloride can be represented by the equation

$$\Delta F^* = -863. + 0.1614\,T \text{ (kj./mole)} \quad (958 \text{ to } 1014^\circ K).$$

The standard free energy of formation of solid plutonium trichloride at one atmosphere can be represented by the equation

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ΔF^0 = -926. + 0.2229 T (kj./mole) (958 to 1014°K).

The standard free energy of formation at one atmosphere of the $PuCl_3$-KCl compounds in the liquid state, provided they exist in the liquid state, may be represented by the equations

$\Delta F^0_{K_2PuCl_5}$ = -1689. + 0.2922 T (kj./mole) (968 to 1027°K)

$\Delta F^0_{K_3PuCl_6}$ = -2104. + 0.3727 T (kj./mole) (968 to 1064°K).

Microfilm $2.00; Xerox $5.00. 97 pages.

A STRUCTURAL AND ANALYTICAL INVESTIGATION OF NICKEL GLYOXIME

(L. C. Card No. Mic 59-887)

Wilfred Michael Biagas, Ph.D.
St. Louis University, 1958

The structure of nickel glyoxime has been determined. The lattice constants are: a = 4.20 Å, b = 7.22 Å, c = 12.48 Å. The crystal is monoclinic with the monoclinic angle, $\beta = 89.3°$. The space group is $P2_1/c$ and there are two molecules in the unit cell.

The approximate atom positions were determined by two-dimensional Fourier methods. The final atom positions were obtained from least squares calculations with the IBM 704 and the NYXRl program. The intensities were estimated visually on Weissenberg photographs.

The molecule is planar with minimum symmetry of $\bar{1}$. However, the molecular symmetry may be as high as D_{2h}. The packing is such that the molecules lie on a series of parallel planes inclined to all three axes of the crystal. There is no interlocking of molecules and metal-metal interaction.

The O - H - O distance is shorter than customary, 2.39 Å, and suggests a strong hydrogen bond. The infrared spectra suggest, by the criteria of Rundle and Parasol, a symmetrical hydrogen bond.

Nickel glyoxime is unsatisfactory as a reagent for determining nickel gravimetrically. Aqueous solutions of the complex at pH's between 7.5 and 10 obey Beer's Law and a colorimetric method for determining nickel may be feasible.

A program for future studies should include investigations of the structures of glyoxime itself and its copper, palladium, and first transition series derivatives. There is need for a complete spectrophotometric investigation over a wide range of wavelengths of the aqueous solutions of the complex. The effect of bases other than NH_4OH on the solutions needs to be determined. Finally, extraction of the colored complex by benzene or chloroform might lead to a simple satisfactory method for determining nickel. Microfilm $2.00; Xerox $4.60. 87 pages.

AN EXPERIMENTAL STUDY OF THE VISCOSITIES OF COMPRESSED GASES

(L. C. Card No. Mic 58-7646)

Russell Vandervort Hanks, Ph.D.
Brown University, 1958

A capillary flow viscometer has been constructed for measuring the viscosities of gases in the pressure and temperature ranges of 10 to 100 atms. and 100 to -78°C. respectively. In this instrument the steady flow of gas effected by a flow meter maintained at room temperature is caused to pass through a capillary tube which is thermostated at the temperature of interest. A dependence upon the equation of state of the gas being studied is thus introduced. The steady pressure difference accompanying the flow is measured with a mercury U-tube differential manometer, also maintained at room temperature.

The viscometer was found to function satisfactorily over the temperature range from 75 to -78°C. and up to 75 atms. pressure, but some difficulty was experienced at higher pressures owing to friction between parts of the flow-meter. The precision with which pressure differences in the range 0.4 - 1.7" of mercury were established was 0.0002", which was also the order of accuracy with which they were measured. The flow of gas was found to be steady to about 0.03% in the range of flow rates 0.02 - 0.1 cc/sec.

Measurements for N_2 at 25 and -78°C. and for He at -78.5°C. up to a maximum pressure of 70 atms. are reported and discussed. An extrapolation procedure, due to Knibbs, was used to evaluate the kinetic energy correction to Poiseuille's Law. The accuracies of the data on N_2 at 25°C. and on He at -78°C. are estimated to be at worst 0.3 - 0.5% respectively. The accuracy of the data on N_2 at -78°C is believed to be of the order of 2 - 3%.

An outline of a new viscometer is presented and discussed. Microfilm $2.00; Xerox $5.20. 102 pages.

A STUDY OF THE HEAT EFFECTS AT ELECTRODES DURING ELECTROLYSIS

(L. C. Card No. Mic 59-1474)

Howard Frank Holmes, Ph.D.
The University of Tennessee, 1958

Major Professor: M. J. Joncich

Temperature difference measurements were made during the electrolysis of aqueous copper sulfate between copper electrodes. The temperature differences measured were those between the cathode and the anode, the cathode and the solution, and the anode and the solution. These values were obtained as a function of the time of the electrolysis. The variation of these differences with time and their magnitudes were explained in terms of the entropy changes occurring at electrodes, resistance, and polarization.

The effect of some inert electrolytes on these temperature differences was determined as was the effect of gelatin. Explanations for these effects were given in terms of

polarization and the thermodynamics of irreversible processes as applied to thermocells.

It was found that these temperature differences were extremely dependent on, and had a definite relationship to, the concentration of the copper sulfate solutions. Accordingly, a method was proposed whereby such temperature differences could be used as an analytical method. This method was given the name, "Thermal Electroanalysis."

A theoretical analysis was made of the quantity of heat evolved by an electrochemical reaction during electrolysis. This analysis was made from the standpoint of the thermodynamics of irreversible processes and its relationship to classical thermodynamics was indicated.

A calorimetric method was developed which made it possible to measure the amount of heat liberated at a single electrode during an electrochemical reaction. It was also possible to measure the total amount of heat liberated by the same electrochemical reaction. These data, coupled with the theoretical analysis, made it possible to calculate the enthalpy change for the total reaction as well as the entropy change occurring at each electrode. This was done for the copper-aqueous copper sulfate-copper and silver-aqueous silver nitrate-silver systems at three different concentrations of electrolyte for each system.

The values obtained for these systems were compared with the existing literature data where possible. Certain differences were pointed out in the case of the entropy values, especially their variation with concentration. Explanations were postulated for these differences and further work was proposed to clarify these points.

In order to test the calorimetric technique and to prove the validity of the method, the enthalpy change for the decomposition of water was measured by this combination of calorimetric and electrochemical techniques. The values obtained were in very good agreement with the accepted value for this quantity. This was considered to be sufficient proof that this technique is a valuable tool for obtaining thermodynamic data which is extremely difficult to obtain by other means.

Microfilm $2.10; Xerox $7.40. 159 pages.

STUDIES IN MOLECULAR SHAPE AND DIELECTRIC RELAXATION TIME, AND IN MOLECULAR STRUCTURE AND DIPOLE MOMENT

(L. C. Card No. Mic 58-7878)

Anthony J. Petro, Ph.D.
Princeton University, 1957

Various aspects of dielectric behavior and the relationships between dielectric constant and molecular parameters are presented and discussed. Methods of determining atomic polarizations and dipole moments are evaluated. The process of dielectric relaxation and its use in describing molecular behavior are discussed. Also considered are relaxation as a rate process and the phenomenon of a distribution of relaxation times. Attention is given to the effect of polarity and viscosity on the relaxation time, particularly the correction for the internal field. A basis is established for the correlation of the relaxation times of molecules of similar size and shape but of different polarity and viscosity.

Apparatus and methods used to determine dielectric constants and losses at wavelengths of 1.25, 3.22 and 10.0 cm. and 300 m. are briefly described, as are the measurements of refractive indices, densities, and viscosities. The calculation of relaxation times and electronic polarizations from experimental data are also discussed.

Measurements of dielectric constant and loss have been carried out at 20, 40 and 60° on toluene, styrene, ethylbenzene, i-propylbenzene, o-xylene, m-xylene, p-chlorotoluene, α-picoline, 2- and 4-vinylpyridine, and 2- and 4-ethylpyridine in the pure liquid state and on solutions of p-chlorotoluene in benzene, p-xylene, and p-dichlorobenzene. The relaxation times and viscosities are examined in relation to molecular size and shape. A regular increase in relaxation time with increasing size of the substituted group is observed for the benzene derivatives with the exception of styrene. The anomalous values for the latter are attributed to planarity of the molecule. The slightly polar hydrocarbons are compared with the polar pyridines. The ratios of molecular relaxation times and viscosities at constant temperature or, equivalently, the molecular relaxation times at constant viscosity are found to be adequate in most cases for correlation of the relaxation times of compounds of different polarity but similar size and shape. A similar correlation is made for p-chlorotoluene between the pure liquid and its solution in non-polar solvents. Activation energies for viscous flow and dielectric relaxation are compared on the basis of molecular size and shape and the mechanism of each process. The difference between the two quantities is found to be a maximum for the nearly planar molecules and to decrease with increasing bulk and irregularity of the substituted group.

Dielectric constants, densities and indices of refraction at five wavelengths have been measured for the pure liquids, benzene, toluene, o-xylene, m-xylene, p-xylene, ethylbenzene, styrene, and i-propylbenzene at 20, 40 and 60°. The electronic polarizations have been calculated by the Lorentz-Lorenz and Cauchy relationships and the total polarizations by the Clausius-Mosotti equation. The electronic polarizations have been found to be density dependent, but a plot of the difference between total and electronic polarizations against the reciprocal of absolute temperature has been found to yield a straight line whose intercept is the atomic polarization and whose slope is proportional to the dipole moment. Values obtained by this method using the Debye equation agree well with those obtained by microwave dielectric constant measurements for all except o-xylene and compounds of higher moments. The liquid and vapor dipole moments have been correlated with the asymmetry of the molecules.

The dipole moments of 1,1,2-triphenyl-1,2,2-tri-p-tolyldisilane, 1,1,1-triphenyl-2,2,2-tri-p-tolyldisilane, and 1,1,1-triphenyl-2,2,2-trimethyldisilane have been determined in dilute benzene solution. The measured values 0.80, 0.77 and 0.64 x 10^{-18}, respectively, have been used to calculate a value of 115° for the aryl-silicon-silicon bond angle. Failure to detect free radicals in solution indicates that the distortion does not lead to measurable dissociation of these compounds. On the basis of available data and the measured moments, the following approximate maximum group moment magnitudes and their directions have been assigned: phenyl$^-$ —$^+$Si = 0.84 x 10^{-18} and tolyl$^-$—$^+$Si = 0.25 x 10^{-18}.

The dipole moment of acepleiadylene has been measured

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in dilute benzene solution at 30°. The measured moment, 0.51×10^{-18}, is 50 per cent of the value predicted by quantum mechanical calculations. Possible reasons for the low moment are discussed.

Measurements of dielectric constant and loss have been carried out on dilute solutions of water, methanol, and chloroform in dioxane at 20, 40 and 60°. The approximate relaxation times obtained are shown to be two to four times greater in dioxane than in non-hydrogen-bonding solvents. The values are discussed in terms of the size of the hydrogen-bonded species formed.

The molecular dipole moments of two cyanine dyes have been measured in very dilute solutions in dioxane. Comparison of the observed moment values 9.8 and 13.3×10^{-18} with those calculated for the possible resonating structures indicates that a full, or nearly full, electronic charge is carried by the acidic radical of the molecule, while an equal positive charge is equally divided between the nitrogens of the two basic nuclei.

Microfilm $2.35; Xerox $8.20. 178 pages.

THE MELTING OF COLLAGEN UNDER STRESS AND ITS ELASTICITY IN THE AMORPHOUS STATE

(L. C. Card No. Mic 59-1526)

Orson Kirk Spurr, Jr., Ph.D.
Cornell University, 1958

Recent successes in characterizing the shrinkage of collagen as a first order phase transition and in interpreting the dependence of the transition on the stress have inspired the study reported in this dissertation.

The melting point of quinone tanned rat tail tendon collagen in H_2O, 1M KCNS, and 3M KCNS diluents was studied as a function of the stress necessary to preserve equilibrium between crystalline and amorphous segments coexisting in the same fiber. Supplementary experiments were performed to determine the lengths of the fibers and their degrees of swelling. These latter experiments were conducted under the various conditions of force, temperature, and diluent encountered during the phase equilibrium measurements. The results were treated with the thermodynamic and statistical-thermodynamic theory for the phase transition under stress. The total heat change in the presence of diluent was calculated and corrected for the integral heat of solution in order to obtain the latent heat of fusion. The resulting latent heat of fusion of 1.3 ± 0.3 Kcal./mole agrees very favorably with the results of other investigators using different methods. Therefore, this correspondence to previous results and the facility with which the data fit into the theory supports the validity of the theoretical treatment and furnishes additional evidence for the existence of the first order phase transition.

Native collagen has an ordered molecular structure which, when cross-linked and subsequently melted, exists as an amorphous network. However, the collagen network differs from the normal vulcanized rubber network in that the latter material is cross-linked in the state of random molecular configurations. Consequently, it was observed that, unlike rubber, the amorphous length of collagen fibers depends on the cross-linking density and the melting point of collagen is elevated by cross-linking. Further, it was shown that the elasticity of amorphous collagen networks fits the form of the statistical-thermodynamic elasticity equations. Agreement was obtained between the experimentally determined elasticity parameter B and its value calculated from independent structural and light scattering data. Aside from an apparent ordering process of undefined character in the temperature range just above the melting point, the temperature dependence of the elastic stress conforms to theoretical predictions. Thus, the assumptions of the theory and of the model for the collagen network are shown to be valid.

Microfilm $2.00; Xerox $7.00. 149 pages.

THE STRUCTURE OF SOME COORDINATION COMPOUNDS OF NICKEL AND PALLADIUM

(L. C. Card No. Mic 59-1240)

James McDonald Stewart, Ph.D.
University of Washington, 1958

An interest in the study of the bonds formed by the transition metals in coordination compounds has led to this investigation. The object of the present research was to establish the inter- and intra-molecular distances in certain representative complexes.

Programs for the Type 650 Magnetic Drum Data-Processing Machine which were prepared in this laboratory by Professor E. C. Lingafelter, Mr. Bruce W. Brown, the author, and by Professor L. H. Jensen of the Department of Anatomy (21) were used to carry out the established calculations of x-ray crystallography (6).

Bond lengths, bond angles, and inter-molecular distances in bis (salicylaldiminato) nickel (II) and diaqua bis (salicylaldehydato) nickel (II) were refined from structures established in an earlier study by another worker (1). The refinements were carried out by means of Difference Fourier syntheses (6). The structures obtained from these refinements established the square coplanar configuration of the ligands about the nickel in bis (salicylaldiminato) nickel (II). The distances between the nickel and the ligand atoms were found to be 1.840 Å. while no atom was found to be more than 0.050 Å. from the plane of the whole molecule as determined by the method of least squares.

The octahedral configuration of the ligands about the nickel in diaqua bis (salicylaldehydato) nickel (II) was calculated to have bond lengths of 2.033 Å. and 2.027 Å. in the the plane of the molecule and 2.041 Å. to the oxygen of the water molecule.

The space group, unit cell dimensions, structure, bond distances and bond angles in bis (salicylaldehydato) palladium (II) have also been determined. The bis (salicylaldehydato) palladium (II) was shown to have the ligands of the palladium in a square coplanar configuration similar to the bis (salicylaldiminato) nickel (II). The bond distances to the ligands of palladium were found to be 1.985 Å. and 2.001 Å.

A description of the modification and calibration of a precession camera for purposes of obtaining integrated intensities is included in Appendix I. A method of correcting relative intensities for the effect of mass absorption has been developed in Appendix II.

Microfilm $2.00; Xerox $4.80. 93 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE EQUILIBRIA OF ALUMINUM HYDROXIDE, URANIUM PEROXIDE DIHYDRATE, AND URANO-URANATE HYDRATE IN ACIDIC AND ALKALINE MEDIA AT 25°C.

(L. C. Card No. Mic 59-1370)

Lancelot Churchill Adalbert Thompson, Ph.D.
Wayne State University, 1955

Adviser: Karl H. Gayer

This investigation was undertaken to obtain data from which (1) the character of the ions in solution could be determined, (2) the free energy of reactions involving these ions could be evaluated, (3) the solubility and solubility product of the hydrous oxide under consideration evaluated, and (4) the extent of the amphoteric nature of the hydrous oxide evaluated.

Three hydrous oxides were studied namely aluminum hydroxide, uranium peroxide hydrate and U_3O_8 hydrate.

From the data obtained from the solubility determination of aluminum hydroxide in dilute perchloric acid and sodium hydroxide at 25°C $\pm$ 0.02°C it seems as if the principal reactions taking place in these solutions at the concentrations studied can be represented by the equations

$$Al(OH)_3(s) + OH^- \rightleftharpoons H_2AlO_3^- + H_2O$$

with an equilibrium constant of 2.10×10^{-1} and a ΔF^0 of 926 cals/mole, and

$$Al(OH)_3(s) + H^+ \rightleftharpoons Al(OH)_2^+ + H_2O$$

with an equilibrium constant of 1.02×10^{1} and a ΔF^0 of -1,360 cals/mole.

The acid dissociation constant for the reaction

$$Al(OH)_3(s) \rightleftharpoons H_2AlO_3^- + H^+$$

is given by 2.10×10^{-15}.

Although this hydroxide exhibits amphoteric properties, from the solubility curve it is apparent that it is more acidic than basic.

The solubility of uranium peroxide hydrate in solutions of dilute sodium hydroxide and perchloric acid at 25°C $\pm$ 0.02°C indicates that the chief reaction in acid is

$$UO_3(OH)_2.H_2O(s) + H^+ \rightleftharpoons UO_3(OH)^+ + 2H_2O$$

with an equilibrium constant of 3.62×10^{-2} and a ΔF^0 of 1970 cals/mole. The principal reaction in base is

$$UO_3(OH)_2.H_2O(s) + 2OH^- \rightleftharpoons UO_5^= + 3H_2O$$

with an equilibrium constant of 0.89 and a ΔF^0 of 69 cals/mole.

This compound is more acid than basic as should be expected, due to the several oxygens associated with the uranium atom.

The water solubility of $UO_4.2H_2O$ obtained was 1.00×10^{-5} moles/1000 grams H_2O at 25°C.

The true solubility of U_3O_8.hydrate could not be obtained in acidic or basic solutions. Equilibrium values were obtained in dilute perchloric acid with the predominant reaction

$$UO_3.H_2O(s) + H^+ \rightleftharpoons UO_2(OH)^+ + H_2O$$

with an equilibrium constant of 1.0×10^{2} with a ΔF^0 of -2740 cals/mole.

This is only valid if it can be assumed that $U_3O_8.xH_2O$ is a mixture of UO_3 and UO_2 hydrates and that the most soluble hydrate is the only one that dissolves without affecting the other hydrated oxide.

The water solubility of $U_3O_8.xH_2O$ was obtained by averaging three values and is 5.0×10^{-5} moles uranium/1000 grams H_2O at 25°C.

Microfilm $2.00; Xerox $3.80. 69 pages.

COLOR CONTACT MICRORADIOGRAPHY

(L. C. Card No. Mic 59-590)

Rita Marlene Uznanski, Ph.D.
University of Illinois, 1958

Contact microradiography is a technique in which a small sample of very thin cross section is exposed to x-rays, and the image recorded on a fine-grained film, in contact with the specimen. The image obtained is then enlarged photographically or viewed under a light microscope.

The action of x-rays upon color film cannot be predicted from any of the laws governing the blackening of normal x-ray film. Even the manufacturers are unable to supply information concerning the action of x-rays on the layered arrangement and the dyes in the emulsion. To determine film response in color film, then, recourse must be taken to experimentation.

In this investigation, the action of x-rays upon Kodak Ektachrome daylight and artificial light film was studied extensively.

In order to facilitate the handling of the film, a brass camera, based on the principle of the regular 35 mm still camera was designed, executed and used in these experiments. The camera was designed in such a way as to make it possible to change specimens without taking the camera off the x-ray unit, or working in a darkened room.

The action of x-rays generated at 40 kilovolts by cobalt, chromium, copper and molybdenum target tubes on the film alone was studied. Copper and molybdenum radiation at 30, 20, 10, 7 and 5 kilovolts, and 35 and 30 kilovolts, respectively, were also investigated. The atomic number of the target element and the kilovoltage determine the wave length distribution, in some instances essentially monochromatic, and hence the penetrating power of the beam.

The colors produced were classified visually according to the Munsell Color System. Colors ranging from blue, blue green, green, yellow, yellow red, and purple blue to gray were obtained. Red, however, was unobtainable.

The reproducibility of the colors under similar exposure conditions was shown, that is, the Reciprocity Law holds for color film. However, the method of film storage before exposure seems to have affected the colors produced somewhat.

The artificial light film produced more saturated colors than the daylight film. For the same value of E (current x time), the same kilovoltage yielded the same color, while a different kilovoltage yielded a different color. The hue, or color itself, varied more from one target to another at the same voltage and E value in daylight film. The hue remained the same after exposure to radiation from any given target for one kind of film. It was easier to

overexpose daylight than artificial light film. The color property of value, decreased with decreasing E. There were greater shifts in value and chroma, or saturation, with decreasing E. Sometimes even a change of hue was evidenced. Herein lies the key to the use of color film in the evaluation of x-ray dosage by color film.

With the new camera x-ray beams from copper and molybdenum targets were transmitted through various metal and wood specimens in contact with color film and the resulting shadow images were examined for color and resolution of fine structure of the specimen.

Artificial light film resolved the structure of metals at several higher voltages, especially with the copper radiation. Softer radiation was needed to resolve the structure in the wood specimens. Specimens containing elements of large atomic number seemed to render the film more sensitive in resolving structure when higher voltages were used.

Green and blue green images were obtained for metal specimens on daylight film, while blue was obtained for metal and wood specimens on artificial light film.

Compared with the conventional method of microradiography on black-white film, the processing time is the same, although much more manipulation is required for color film. Because of the rather large grain size, extensive enlargement of the color microradiographs is not feasible. However, the use of these transparencies as slides is very convenient. The results indicate some interesting and valuable applications in radiography, microradiography and dosimetry, and have established the background techniques for the development of new color film formulations more specifically adapted to radiation in the x-ray and γ-ray ranges of the electromagnetic spectrum.

Microfilm $2.00; Xerox $5.20. 103 pages.

SOME ANALYTICAL ASPECTS OF RAMAN SPECTROMETRY IN LIQUIDS AND SOLIDS

(L. C. Card No. Mic 58-7936)

Frederick Vrátný, Ph.D.
Indiana University, 1958

A Raman instrument has been constructed, for use with liquids and solids, employing 2537 Å mercury excitation. A helical quartz lamp, four inches in diameter and eight inches long, was used for excitation of liquids. A quartz Wood's model tube, two inches in diameter, was used to hold the sample. The Wood's tube was fitted directly into a light shield. An S-shaped lamp about five inches by six inches was used for excitation of solids. The powdered sample was mounted between quartz flats held in a special ring closure. Excitation occurred in transmission through a thin layer of powdered solid. Sample thickness ranged from about 0.1 mm. to 3.0 mm., depending upon the optical density of the sample. A three inch diameter plano-convex lens with focal length of eight and one-half inches was used to gather and focus the light upon the slit. A mercury resonance filter was used between the lens and slit and proved to be of tremendous value in reducing background as well as for partial or complete removal of the 2537 Å exciting line.

A one and one-half meter concave grating A.R.L. spectrograph was used as a monochromator. Dispersion and resolution were very good, but without the resonance filter large grating ghosts would have precluded the use of this type of monochromator. Spectra were recorded on thirty-five millimeter strip film and densitometer tracings were made from the film with a Leeds and Northrup recording densitometer.

Two liquids were studied -- aqueous sulfuric acid and phosphoric acid. In the former a normal correlation of increasing intensity with increasing concentration was observed. In the latter the converse was observed, i.e., decreasing intensity with increasing concentration. It was also observed that sulfuric acid does not absorb appreciably in this region of the spectrum and phosphoric acid does. These observations were then interpreted and explained on the basis of the law of light absorption. A mathematical formula is proposed to explain the effect of absorbancy on Raman and Rayleigh intensity, and another formula is proposed for the ratio of Raman to Rayleigh intensity. Intensity curves calculated from these formulas compare quite favorably with the observed intensities.

The formulas were also used to predict intensity curves for the variables:

a, absorbancy coefficient

l, length of tube

D, diameter of tube

c, concentration

Consideration is also given to the special cases of high and low absorbancy.

Raman spectra of five solids were studied intensively. They were potassium sulfate, sodium carbonate, potassium chlorate, calcium phosphate, and calcium carbonate. Many other solids gave successful spectra. However, decomposition due to ultraviolet light causes limitations. Several factors affecting Raman intensities in solids were studied. It was observed in the case of calcium carbonate that an optimum thickness of sample is desirable: when the sample is too thin, there is insufficient material to be excited and the transmission of mercury lines is too high; when the sample is too thick, the absorbance is the controlling factor rather than Raman scattering.

When a material of low absorbancy is mixed with a material of low absorbancy, the usual increase in intensity with increase in concentration is obtained. This was observed for potassium sulfate, potassium chlorate, and to a large extent for sodium carbonate. For a material of high absorbancy mixed with a material of low absorbancy, it was observed that with increasing concentration there was first an increase and then a decrease in intensity. These data have been interpreted in terms of optical absorbancy laws and equations derived therefrom.

Microfilm $2.85; Xerox $9.80. 218 pages.

ECONOMICS, GENERAL

THE MEAN AGE AT MARRIAGE IN INDIA AS ASCERTAINED FROM CENSUS DATA

(L. C. Card No. Mic 58-7810)

Shri Narayan Agarwala, Ph.D.
Princeton University, 1957

Adequate statistical information relating to the components of population change is generally lacking in underdeveloped countries of the world. In view of the growing desire to know the prospects and magnitudes of population potential in these countries, which unfortunately also happen to be statistically immature, demographers have begun overcoming this difficulty by suggesting methods of approximating different measures of fertility and mortality. Their efforts are generally directed towards finding out indirect methods of measurement through the use of information customarily available in different censuses, which are, fortunately, becoming increasingly common in these countries.

The present work is also an effort in the same general direction. It suggests ways and means for approximating different measures of nuptiality from the use of census information on civil condition. It shows that measures like the mean or median age at marriage, marriage frequency, marriage probability and the like, can be calculated by the use of the census data when marriage certificates are not available. It shows that various measures of nuptiality calculated from the use of census data will give results closely approximating those available from marriage certificates, provided the census information is reliable.

Various measures of nuptiality obtained from a single census, provide a cross-sectional picture of the marriage experiences of a population extending to various degrees into the past, and can be adequate for comparing groups with persistent differences in the age at marriage (like regional, international and religious comparisons) on the assumption that short term differences in each are minor as against major differences among them. But if the age pattern of marriage has been changing, then the "decade synthetic cohort" approach is the desirable technique to use, because it isolates the marriage experience of each decade and shows the mean age at marriage of a synthetic cohort with the experience of a decade.

Different measures of nuptiality suggested above have been obtained for India by using the census information on marital status for the period 1891 to 1951. The mean marriage age of the no-mortiality female decade synthetic cohort, which was 12.77 years in 1891-1901 has risen to 15.33 years in the 1941-1951 decade, while the mean marriage age of the corresponding male decade synthetic cohort has declined from 20.01 to 19.93 years. While the marriage frequency curve by age for females is shifting to the right, suggesting a tendency towards a decline in child marriages, that of males is tending to shift to the left showing an increase in child marriages.

Marked regional differences in the mean marriage age of the two sexes exist in India. On the whole, the states in the south (Madras, Mysore and Travancore-Cochin), northwest (Punjab) and east (Assam) have a higher age at marriage than the rest of the states. Religion and caste differences in the mean marriage age are also well marked. Christians have the highest mean age at marriage, followed by Sikhs, Muslins and Hindus, who have the lowest. Among different castes, the trading caste females have the highest mean age at marriage, followed by warrior, Brahman and scheduled castes. The males have generally the same ranking, except that the warrior caste males instead of the trading caste have the highest mean marriage age. Although there are differences by caste and religion, marked regional differences among each one of them (excepting Brahman caste females) are also to be found.

Question of differential mortality by marital status has been examined and it has been found that it has an insignificant effect on the calculated mean marriage age. Net migration also seems to have a minor effect on the mean marriage age in Indian and, therefore, for most purposes it may be neglected without prejudicing the accuracy of the computed mean age at marriage significantly. A number of suggestions regarding the nature of the data necessary for further analysis in the field of nuptiality and fertility in India have been made.

Microfilm $4.80; Xerox $18.40. 374 pages.

CHILE'S BALANCE OF PAYMENTS, ECONOMIC DEVELOPMENT, AND FOREIGN ECONOMIC POLICY

(L. C. Card No. Mic 59-357)

Eric Nicolas Baklanoff, Ph.D.
The Ohio State University, 1958

Among Latin American countries, Chile presents an especially interesting case study involving the impact of government policy on economic processes and events. This is particularly true in view of Chile's failure to participate in Latin America'a rapid economic growth in the years following the end of World War II.

The study is limited primarily to an analysis of the external sector of the economy and to the role of foreign economic policy in economic development. In general, it emphasizes developments since 1945, with an anchor laid down in the interwar period as a basis for measuring subsequent changes.

An examination of Chile's foreign trade revealed that the contraction in Chile's capacity to import in the postwar years relative to the late twenties had an inhibiting effect on capital formation, since about 90 per cent of total investment in machinery and equipment is represented by imported capital goods. A fall in capital-equipment imports per worker of nearly 50 per cent between the periods

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1925-1930 and 1949-1952 suggests one reasonable explanation for the slow pace of the country's economic growth. An important reason for the deterioration in the capacity to import was the failure of the physical volume of exports to expand.

Chile's multiple exchange system together with other instruments of trade control served to concentrate resources in manufacturing industry as part of the broad orientation of "internal development." The manipulation of multiple exchange rates adversely affected such basic sectors as agriculture, the copper and nitrate mining industries, and a number of potential export industries. Chile became converted into a net agricultural importing country, a condition which brought to bear increasing pressure on scarce foreign exchange resources.

The multiple exchange system inhibited the very export industries in which Chile has a comparative advantage. The large foreign-owned mining companies that provide Chile with about three-fourths of its gross export proceeds were obliged to surrender foreign exchange at penalty rates in order to cover their local expenses, and the effect of this was to raise appreciably their costs of production in dollars, lower their profits, and dampen their incentives to expand. Herein lies the principal cause for the failure of the physical volume of exports to grow. As a result of this policy, Chile's share in world copper production fell from 19.7 per cent in 1944 to 12.9 per cent in 1954, and the long-established nitrate industry was almost brought to the point of bankruptcy.

Fortunately, in the very recent past, there has been a major policy shift which is reflected in a number of concrete measures, including the Stabilization Program, the Exchange Reform, the "New Treatment" Copper Law, the Nitrate Referendum, and the elimination of price control for agricultural products. In response to an improving economic climate, new foreign capital is flowing into Chile, with present commitments exceeding three hundred million dollars.

The combination of a narrow domestic market, specialized resources, and a critical shortage of foreign exchange suggests that Chile's best hope for an economic "breakthrough" lies in the expansion and diversification of exports and in a comprehensive agricultural development program.

The results of market analyses are exceedingly encouraging. The outstanding export opportunity lies in a potential pulp and paper industry which would provide Chile with a new source of net foreign exchange second only to copper.

Microfilm $3.70; Xerox $12.60. 287 pages.

INTERREGIONAL COMPETITION IN FRESH VEGETABLES

(L. C. Card No. Mic 59-346)

Donald Edward Farris, Ph.D.
North Carolina State College, 1958

Supervisor: Richard Adams King

The purpose of this study was to evaluate the marketing advantage of North Carolina producers of certain vegetables for fresh consumption. Economic theory relating to interregional competition provided a guide for measuring the marketing advantage of different producing areas. Special attention was given to locational advantage in producing slicing cucumbers and green peppers.

The United States was taken as a closed market; and data on prices and receipts were obtained for 22 major markets distributed throughout the country from Los Angeles, California, to Boston, Massachusetts, and from Seattle, Washington, to Atlanta, Georgia. A transportation cost function was developed in order to estimate the cost of moving cucumbers and peppers from producing areas to each of these cities. The transportation model was used to determine minimum cost product flows and intermarket price differentials. In selected cities the nature of short-run demand was investigated to determine the effect of volume of receipts on price.

Efficiency of the industry in allocating supplies from producing areas to consuming centers was shown by the fact that the minumum cost routes would have reduced the cost of actual shipments by less than five per cent in all but 4 out of 18 weeks. Using 1956 shipment data, the locational advantage of North Caolina over South Carolina in marketing cucumbers ranged from $0.04 to $0.10 per bushel; the advantage of North Carolina over Florida was from $0.25 to $0.34, and over California, was from $0.74 to $0.99 for the three weeks selected for study. Producers on the Eastern Shore had an advantage over North Carolina of $0.14 to $0.27 per bushel late in the North Carolina season, while midwestern growers had an advantage of $0.15 to $0.50.

When North Carolina cucumber shipments were arbitrarily increased by 20 per cent over the peak week of 1956, the locational advantage decreased slightly compared to nearby competing areas while North Carolina's position related to California changed from a $0.74 advantage to a disadvantage of $0.44 per bushel.

In the production of peppers, North Carolina had a small locational advantage in the first part of the 1956 season, but after the North Carolina peak was reached, areas to the North with $0.20 to $0.50 per bushel locational advantage started shipping. To increase net income from pepper production during this period, greater production and marketing efficiency would be necessary to offset the state's locational disadvantage.

Early in the season the best markets for North Carolina cucumbers and peppers were located in the northeast and as far west as Pittsburgh. After the peak shipping season had passed, the optimum markets were farther west, with New York and Philadelphia supplied by the producers of Maryland, Delaware, New Jersey and Virginia. Price analysis showed that in this period North Carolina shippers could usually increase their returns by routing more shipments west into Cleveland, Cincinnati, Chicago, and Detroit.

Microfilm $2.70; Xerox $9.40. 206 pages.

A SOCIO-ECONOMIC APPROACH TO PROMOTING ECONOMIC DEVELOPMENT IN EASTERN NIGERIA: WITH SPECIAL REFERENCE TO AGRICULTURE

(L. C. Card No. Mic 59-133)

Benjamin Uzoukwu Nzeribe, Ph.D.
Cornell University, 1958

Six major categories of economic problems currently facing Eastern Nigeria and threatening the standard of living of the people are defined and characterized as follows: a rapid growth of population vis a vis a stagnant technology of production; an increasing incidence of soil erosion and other natural resource waste; an increasing expectation of a higher standard of living for the great majority of the people; problems arising from a traditional system of food-agriculture which produces mainly tuberous crops and therefore an unbalanced diet; adverse world market outlook for the oil palm produce, the mainstay of the economy; urgent need for industrial raw materials.

A model of growth and economizing principles is built and the importance of change as a pre-requisite for growth is emphasized. The conventional investment allocation criteria are examined and the non-operationalness of the social marginal productivity formula and the costs/benefit calculus strictu sensu in E. Nigeria is pointed out. The needs and priorities, shortages and bottlenecks are obvious enough to be a guide in the Region.

Government as the motive force of economic development should concentrate on inducing the qualitative changes that will promote enterprise and channel it in directions conducive to growth by creating opportunities for individuals and groups to acquire growth-promoting skills, entrepreneurship, and community leadership; by creating opportunities for willing and able groups to obtain financial and technical aid; by discouraging and penalizing growth-inhibiting activities; and by creating a socio-political environment favorable to enterprise.

The quickest way to achieve a substantial measure of growth is to develop agriculture first and industry later. Arguments in support of this assertion are advanced: food import is not feasible; agriculture and rural production can be raised with relatively little investment and within a relatively short period of time by grafting new techniques on to the existing socio-economic system; new measures needed in agriculture are not restricted by the scarcity of capital and skills. Per contra, industrialization is a complex and expensive undertaking requiring resources and facilities -- savings, access to external markets, access to strategic raw materials, and a large scale potential external economies -- which the Region does not at present possess.

The dimensions of the present system of agriculture are diagnosed in engineering terms: its pathology includes use of primitive techniques and methods, wasteful utilization of land both in space and time, inadequate supply of effective labor, and increasing fragmentation of holdings. But these weaknesses are technically surmountable by introducing improved methods, implements, livestock, breeds, irrigation, and soil conservation measures.

Obstacles to the adoption of these technical measures are mainly institutional. Outstanding among these are: the existing system of land laws, in which rights and titles are mainly "derived" and not adequately defined, and in which religious taboos and a discriminatory attitude towards the "stranger" predominate; a negative attitude on the part of the government, the administration, the elite, and the educational system; limited savings institutions and the existence of institutionalized conspicuous consumption patterns.

A new approach to removing these social obstacles must aim at stimulating a mass movement in which both people and government are actively involved, the former as effectuators of change and the latter as facilitator. Motivations are to be stimulated and opportunities created within the major grass roots functional institutions already existing in the society, viz the extended family, the age groups, the patriotic unions and the emerging private associations of embryonic entrepreneurs. Government's facilitative measures would include enactment of a Public Trust Provision to permit able and willing groups to get the land resources needed for agricultural development; a subsidy law to help farmers undertake innovative activities; a promotive law to induce efficient husbandry; restrictive and prohibitory laws to penalize growth-inhibiting activities; and establishment of new training institutions to teach new ideology and next-steps technology and to train grass roots extension workers.

To effectively implement these new measures it is recommended that there be established an Economic Development Authority with features like those of autonomous public corporations in the United States.

Microfilm $5.50; Xerox $19.60. 431 pages.

THE ORIGINS OF THE INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

(L. C. Card No. Mic 58-7871)

Robert W. Oliver, Ph.D.
Princeton University, 1957

Two years passed, following World War I, before there was any concerted international attempt to arrange for the reconstruction of Europe. Even then, the ter Meulen plan, which was proposed at the Brussels Conference in 1920, received only token support and proved to be ineffective. Other proposals for international action received even less attention.

But recovery did occur, however slowly and however much bitterness remained.

After 1922, a number of banks cooperated in arranging currency-stabilization loans, most notably for Austria, and it appeared for a time that the inter-central bank cooperation recommended at the Genoa Conference might insure international economic stability. But the banks were unable to halt the credit crisis of 1931.

Meanwhile, private American foreign lending, which had reached an unprecedented volume in 1927-28, abruptly ceased, and this added to the balance of payments difficulties of the debtor nations, many of whom defaulted on their obligations.

In England, during the 'twenties, John Maynard Keynes warned the British that their foreign investments were excessive, and he remained thereafter unimpressed by the alleged virtues of long-term international capital movements. In 1931, he did propose the establishment of a Supernational Central Bank which might insure international price-level stability, but his plan received little support.

For a time it appeared that the Bank for International Settlements might contribute to European economic stability. But the Bank was rendered impotent during and following the credit crisis of 1931.

At the London Conference of 1933, the French led an unsuccessful attempt to restore the international gold standard, but it was the Americans, following their devaluation of 1933-34, who pressed most strongly for an international agreement to stabilize exchange rates. They sponsored the Tripartite Agreement of 1936 and sought thereafter a more permanent approach to the problem of promoting international economic stability.

In 1939, Dr. Harry White, the Director of the Division of Monetary Research of the United States Treasury Department, was instrumental in drafting a plan for an Inter-American Bank. Though this plan came to nothing, White soon began work on a more grandiose proposal for an International Bank for Reconstruction and Development and an International Monetary Fund. His proposal was first circulated within the United States government early in 1942.

It was not, however, until September, 1943, that White's Bank plan was actively considered by the American Technical Committee, by which time it had been made considerably less ambitious. It was not until June, 1944, that the British developed any enthusiasm for the Bank plan, though, at the Bretton Woods Conference in July, 1944, they supported it along with the compromise plan for an International Monetary Fund.

Following considerable debate, the Bretton Woods Agreements Act was passed by the United States Congress in July, 1945. In December, 1945, the British, after having been promised a large American loan, ratified the Bank and the Fund, and they were quickly followed by most of the other Bretton Woods signatory powers except the U. S. S. R.

At Savannah, Georgia, in March, 1946, arrangements were made for the inauguration of the two new international organizations, and they began operations the following month. A year elapsed before the Bank extended its first loan and sold its first bond issue. The Bank never contributed as much as had been expected to postwar reconstruction, and its operations to date have been somewhat at variance with the original conception of Dr. Harry White. But the Bank is now generally acknowledged to be a successful and worthwhile agency for international cooperation in promoting the development of underdeveloped areas.

Microfilm $10.20; Xerox $36.40. 808 pages.

THE EFFECT ON IMPORTS FROM CANADA OF UNITED STATES TARIFF REDUCTIONS UNDER THE RECIPROCAL TRADE AGREEMENTS PROGRAM

(L. C. Card No. Mic 58-7880)

Gerald A. Pollack, Ph.D.
Princeton University, 1958

Of the trade agreements negotiated by the United States under the Reciprocal Trade Agreements Program, those concluded with Canada were particularly important. This dissertation has the objective of (1) analyzing the validity of various methods for measuring the effects on trade and prices of tariff reductions, (2) examining the effects on the volume of imports from Canada and the level of domestic prices of American tariff reductions on a selected number of commodities, and (3) critically examining the frequent Canadian contention that the American tariff hinders Canada's development as a manufacturing nation by denying Canadian manufacturers access to the American market.

The methods for measuring the effects of tariff reductions considered included partial equilibrium models using empirically derived supply and demand functions, aggregative measures of the height of tariffs, such as ratios of duties collected to total or dutiable imports, the use of international cost comparisons for judging the restrictiveness of tariffs, the concept of "effective protection," defined as that percentage or amount by which a statutory duty allows a manufacturer's processing costs to exceed those of a foreign competitor, and other commonly used aggregative methods. All of these techniques were found to be inadequate for a number of reasons, among them the interdependence of variables assumed independent, the variability of factors assumed constant, the inability to identify functions, and distortions caused by commodity aggregations. Because of these difficulties, the analysis proceeded in a general equilibrium framework and a number of commodities were selected for individual study. An attempt was made to take into account the simultaneous operation of all relevant variables, to weigh their importance, and thus to estimate the relative importance of tariff reductions alone.

The commodities chosen for analysis included all commodities in Canadian-American trade involved in escape-clause petitions to the Tariff Commission before February, 1958, which were considered of sufficient merit by the Commission for a full investigation. While this did not yield a representative sample, and did not necessarily lead to the consideration of commodities on which tariff reductions had the most important effects, it assured consideration at least of some commodities on which tariff reductions may have been noteworthy. Two additional commodities important in trade, lumber and whisky, were also selected.

Although tariffs were reduced between 50 and 75 per cent on eight of the ten commodities considered, a careful examination of the supply and demand conditions in the case of each product failed to establish a strong relation between lower tariffs, increased imports, and changed prices. Indeed, in the case of every one of the ten products considered, factors other than lower tariffs appeared chiefly responsible for such changes as were observed. Because the number of commodities examined is small in relation to the many thousands of commodities imported from Canada, and because there is no reason to believe that they constituted a representative sample, no general conclusions regarding the effects on imports and prices of American tariff reductions are possible. However, the analysis suggests that even substantial tariff reductions were often not chiefly responsible for such changes in the volume of imports and price levels as occurred.

Finally, the study attempted to determine whether the structure of the American tariff seriously distorts Canada's economic development. In general, exports of Canadian manufactures to the United States are limited by higher manufacturing costs in Canada than in the United States. Available studies of the magnitude of the economies of scale were examined, but these were not directly relevant to Canada. One could conclude from them only that longer production runs in some but not all cases might result in significant cost savings.

However, even if a number of Canadian industries could achieve substantial economies through longer production runs, such advantages would probably be offset, at least in

part, by increasing costs and perhaps by changes in the Canadian-American exchange rate. Moreover, Canada would probably retain a comparative advantage in primary production, and the international market mechanism would not then result in a general transfer of resources to secondary from primary industries where economies of scale are presently realized.

If American duties were eliminated, however, there would probably be an expansion in those industries which process, to an intermediate stage, Canada's raw materials, and processing may be carried somewhat further in Canada than is presently the case. However, American tariff reductions since 1930 have generally carried duties to numerically low or moderate levels, and probably many of the Canadian manufacturing industries which cannot enter the American market over existing tariffs could not compete in the United States even if there were no American duties. Microfilm $6.20; Xerox $22.00. 488 pages.

A COMPARATIVE ANALYSIS OF MANPOWER MOBILIZATION IN GREAT BRITAIN AND THE UNITED STATES DURING WORLD WAR II

(L. C. Card No. Mic 59-989)

Rudolph Albert White, Ph.D.
University of Alabama, 1958

Manpower mobilization is an area of public policy which lends itself to a study of "normal" behavior which must adjust to the impact of war. Certain important public control implications derive from analyzing the changes in goals, values, the mechanism used to ensure efficiency in manpower utilization, and the results of various policies.

The comparative analysis proceeds by stages since calendar time is not mutually significant to the two countries. Nor are the final policies, without their evolutionary base, an adequate basis for analysis. The major functions of mobilizing manpower are analyzed for Great Britain and the United States during the prewar, transitional, peak, and final stages of program development.

Britain's war program began from a considerably tighter manpower base than that found in the United States, requiring her more quickly and drastically to redistribute her manpower to war uses. The greater reserves of manpower in the United States were represented by a labor force participation rate which was roughly 7 per cent lower, a level of unemployment more than twice as high in percentage terms, a higher level of worker productivity, higher consumption levels, and a considerable amount of employment in "luxury" production areas.

Both Britain and the United States began their mobilization efforts by depending upon the normal functioning of the labor market. However, differential conditions in the manpower base in Britain and the impact of war indicated that the wage vehicle alone could not achieve quickly and accurately the large changes required without creating serious problems. The extreme, rapidly shifting needs called forth new, "Compulsory" policies to determine who would work, to allocate the manpower according to the new urgencies, to transfer the workers to the new uses, and to secure efficient usage in line with the new goals. Since the framework, goals, and guides to behavior were changed, the manpower authority also found it necessary to regulate the conditions under which labor would be utilized, with control being applied to the behavior of both workers and employers.

The program in the United States remained largely one of dependence on market operations, modified only during the most extreme pressures to control the "new hires." The more important problems of production and stabilization were considered, practically, apart from the underlying manpower factor. Employment was increased by over 19 million persons and some slack still remained in certain areas. Market forces and indirect (in manpower terms) policies were able to channel roughly 25 million persons into war employment. Consequently, since war demands could be met without overriding basic peacetime values and behavior, more stringent policies were not warranted.

The nearness of the war and its shock effect undoubtedly created both special problems and a greater degree of social acceptance of the need for the drastic program developed in Britain. However, the British people and their institutions do not seem sufficiently different to suggest that their program covered only a special case. Their program does suggest certain gudies for public control which would be necessary if the United States began a rigorous war program from a high level of economic activity.
Microfilm $5.65; Xerox $19.80. 444 pages.

ECONOMICS, COMMERCE — BUSINESS

THE DEVELOPMENT AND PRESENT STATUS OF THE ACCOUNTING CONCEPT OF SURPLUS

(L. C. Card No. Mic 59-468)

Billy Lee Barnes, Ph.D.
University of Illinois, 1958

Since corporate surplus emerged in the seventeenth century as an integral part of the financial structure of the business corporation, it has undergone a significant evolutionary development. From a simple concept essentially synonymous with business profits at the time of its inception, surplus became so complex that by the mid-point of the twentieth century its concept was perhaps the most nebulous concept in the field of accountancy. From a relatively insignificant factor in the corporate financial structure, surplus had increased to such magnitude that a nebulous concept was intolerable.

The purpose of this study is (1) to determine the distinctive concepts by which surplus has been viewed during that period; (2) to examine the environments within which the corporation has existed, in an attempt to identify some of the factors, especially those exogenous to accounting, which influenced the changes in the accounting concept of surplus; and (3) on the basis of the findings to present some of the desirable and probable future developments in the area of corporate surplus.

A concept of total capital, adequate for the single venture, was inadequate for the perpetual business enterprise with diverse ownership. The concept of surplus had its genesis in the dichotomy of the concept of total capital into separate concepts of permanent capital and surplus.

Until the latter part of the nineteenth century, a concept of one general surplus, closely related to retained income,

was generally accepted. Beginning then, the major developments in surplus included the introduction of surplus reserves, the use of surplus as a material source of financing, and significant progress in income determination. Dividend, reserve, and financing policies indicate an underlying utilization concept of surplus.

As increments other than earnings -- such as capital gains, premium on stock, and unrealized appreciation -- made their appearances, accountants at first were content to overlook their divergent natures, and the concept of one general surplus carried over into the twentieth century. The shift from short term to long term financing, the passage of the Revenue Act of 1913, and the introduction of no-par stock, however, introduced elements which made that concept inadequate. Of greater significance was the contribution of academicians and theoreticians in spelling out the nature and function of surplus, and the recognition of a social responsibility by practitioners. Together they directed their efforts toward the correlation of economic reality and legal doctrine into a sound accounting structure.

A multiplicity of heterogeneous items was the basis for much experimentation in surplus classification, and as a result, a source concept was superimposed upon the utilization concept. Separate concepts of earned, capital and appraisal surplus replaced the general surplus concept. Earned surplus emerged as the major surplus concept and has undergone relatively little change. Capital surplus reflects the effect of the concept of legal capital in disregard of economic reality. Originally it included all surplus except earnings, but currently is restricted to capital contributions by stockholders and others. Appraisal surplus has received support from most businessmen and economists and some accountants. It currently is rarely recognized in practice.

It is recommended that the source concept be applied to the entire stockholders' equity and that there be more complete disclosure relative to the utilization of earned surplus. It is predicted that paid-in surplus will lose its separate identity as the solvency test for legal dividends minimizes the importance of legal capital, and that eventual recognition of unrealized appraisal increments is almost entirely dependent on the trend in the price level.

Microfilm $3.75; Xerox $12.80. 292 pages.

A REEVALUATION OF ACCOUNTING CONCEPTS TO MEET THE REQUIREMENTS OF A DYNAMIC ECONOMIC ENVIRONMENT

(L. C. Card No. Mic 59-979)

Frederic Augustin Brett, Ph.D.
University of Alabama, 1958

Shortly after the turn of the present century, the phenomenal growth of the corporate business structure gave impetus to the need for improved accounting practices which would reflect more informative data in financial reports. To meet this broadened social implication of business, accountants developed many new techniques and procedures to augment the nucleus of accounting concepts and doctrines formulated over several hundreds of years.

In the development of the new techniques, primary consideration was given to the formulation of practical expedients to meet the pressing requirements of the day. This approach caused accountants to concentrate their efforts on remedial measures rather than on basic investigations into the nature and causes of the problems.

In an attempt to contribute toward possible solutions of some of the problems confronting the profession, this study undertook a basic analysis of income. During the course of this study, it was ascertained that income could be analyzed either from the point of view of the capital yielding it or in relation to the owners receiving it. As accountants appear to have limited their theoretical investigations of income to the second approach, this study used the alternative approach and analyzed income from the point of view of the capital yielding it.

The first step in making this analysis was to examine existing concepts and doctrines as to intent and purpose. Although it was found that the application of these concepts to financial data produced the information they purported to reflect, some doubt was raised as to whether this information was the information which was required by the various users of published financial data.

The second step in the investigation involved the analysis of business capital using basic economic theory and statistical methods. This analysis disregarded existing accounting concepts and investigated income from the viewpoint of the average businessman and other technically untrained users of published financial data. Five basic conclusions are drawn from this analysis:

1. Income, for accounting and financial purposes, must be measured in terms of money.

2. Income is measured by determining the relative change in the economic position of a business entity between two points in time. To make this measurement, an invariable measuring unit must be used. Thus, by necessity, any change in the value of the measuring unit, the dollar, must be considered.

3. Income is considered to accrue to a business entity when it is earned through active business dealings or through "abstinence." Under either condition, income must be at the disposal of, or under the control of, the business entity.

4. In measuring income earned through abstinence, consideration must be given to the intended use of the capital from which the income is derived. In making this analysis, all business capital is classified as circulating capital or fixed capital. A further classification as to the intended use of the capital requires each item to be designated as having value in exchange or value in use. By necessity, all circulating capital items have value in exchange. Fixed capital items, however, may have value in exchange or value in use depending upon managerial intent. Income earned through abstinence is measurable, for accounting purposes, only for items which have value in exchange.

5. Applying the new income recognition concept to the accounting records of a business entity results in the recognition of income in the periods when the economic gains were made rather than in periods when actual transactions took place. This condition is believed advantageous in that business taxes would be charged to periods of economic prosperity and not deferred to periods which may have no direct association with the economic gain.

Microfilm $2.30; Xerox $8.20. 176 pages.

THE EXTENSION OF THE ACCOUNTING METHODOLOGY BEYOND THE ENTERPRISE

(L. C. Card No. Mic 59-510)

Werner George Frank, Ph.D.
University of Illinois, 1958

The objective of this study is to determine whether the characteristics of the accounting methodology are such as to permit it to be applied to units larger than the enterprise. In the light of this objective, the study is basically oriented around the conception of accounting as a technique, rather than around specific uses which may be made of accounting data.

The essential characteristics of the accounting methodology are taken to be the following:

(1) Accounting data originates as a type of description.

(2) This description is in quantitative terms using a monetary measuring unit.

(3) The subject matter of this description are the financial and economic activities of an organized unit together with the means for carrying out these activities and the results of these activities. The characteristic of any unit is its internal homogeneity; as applied to accounting, this homogeneity arises out of the related activities carried out by the unit and the real goods and services and financial claims attributed to the unit.

(4) This description is expressed through a double-entry framework. The significance of the double-entry framework is seen in the means of integration which it provides for relating on the one hand, both economic and financial phenomena, and on the other, both balances of items at any one time and changes in these items over a period of time; i.e., of stocks and flows.

The a priori possibility of extending the accounting methodology (in the sense in which it has been described above) beyond the enterprise is suggested by the frequent occurrence in many fields of study of a range of units, each forming a component of a larger unit and consisting itself of a group of smaller units. Such a relationship might be termed the micro-, macro-relationship. The national income-product accounts, the input-output system, the flow-of-funds system, the international balance of payments descriptions, and certain other sector statements were examined in this study as examples of quantitative descriptions in the area of macro-economics to determine whether such descriptions could be viewed as arising out of the extension of the accounting methodology to this area.

It was concluded that such macro-economic descriptions as the ones examined represent quantitative descriptions of economic and financial phenomena which are measured in monetary terms. Surface differences in presentation of economic activities and stocks and financial activities and claims existed, but were deemed to have arisen out of the special-purpose nature and narrow scope of some of the descriptions rather than fundamental and unreconcilable differences in viewpoint or concept. The accounting units with which these descriptions were concerned met the requirements of an organizational unit in that the activities they carried on and/or the assets and claims attributed to them had special meaning which was given in terms of the organizational units defined. While not all of the individual macro-economic descriptions were specifically cast in a double-entry format, the group of descriptions considered as a whole gave evidence of the interrelatedness and the connections that the double-entry framework basically provides. The existing attempts at integration of these macro-economic descriptions may be viewed as an approach to a more formal accounting structure.

In the broad sense in which the concept of the accounting methodology has been defined and used in this study, it provides a single, unified basis underlying description at both the enterprise level and more aggregate levels. This thesis outlines this framework and shows how it applies to units larger than the enterprise.

Microfilm $2.60; Xerox $9.00. 200 pages.

COMMERCIAL ARBITRATION

(L. C. Card No. Mic 59-896)

John Joseph Glynn, Ph.D.
St. Louis University, 1958

Modern business relationships have become more involved and complex as national and international trade have increased in tempo and volume. Consequently, we have today the problem of the expeditions and just settlement of an ever-increasing number of disputes, between business firms, which arise out of commercial transactions. The need for commercial arbitration of trade disputes, therefore, has been greatly accentuated on both the national and international level. This dissertation is a study of this critical problem of trade disputes and their possible solution by the machinery of commercial arbitration. The traditional method of resolving trade disputes in many cases is recourse to litigation, a time-consuming and expensive procedure for the businessman. Research has been made into the principles, standards, procedures, and the practice of national and international commercial arbitration. The research has included inquiry into such important national and international commercial arbitration institutions such as the Chamber of Commerce of the United States, the Chamber of Commerce of the State of New York, the New York Stock Exchange, the American Arbitration Association, the International Chamber of Commerce's International Businessmen's Court, the International Council on Advertising Practices, and various trade associations practicing arbitration. The purpose of this research has been to ascertain the utility and practicability of commercial arbitration as an alternative to court action in the amicable settlement of business disputes inevitable in a world rapidly becoming more complex.

As a result of this research into the principles and practice of commercial arbitration, certain conclusions were reached. Research shows that the practice of commercial arbitration is limited, for the most part, to remarkably few trade associations, stock and produce exchanges, and chambers of commerce. These business organizations have successfully applied the principles of arbitration. Its advantages to the businessman, however, are too great to have such limited scope. Furthermore, it is concluded from research that commercial arbitration provides an important self-governing machinery for economically and effectively resolving difficult trade controversies while preserving friendly commercial relationships. It is the businessman's way of recognizing more fully his social responsibilities and at the same time

establishing a procedure for achieving equitable, quick, and final decisions in trade disputes. It was further concluded that commercial arbitration has the decided advantage of employing experts as arbitrators. In addition, it is a low cost procedure which merits serious consideration by businessmen. Another conclusion derived from research is that commercial arbitration cultivates a spirit of goodwill and cooperation among businessmen in the settlement of disputes. A thorough examination of the procedures and practice of commercial arbitration amply demonstrates that it has a salutory effect on business standards and codes of ethics.

The interdependency, today, of national and international trade warrants a more widespread application and practice of the principles and standards of commercial arbitration.

Microfilm $3.00; Xerox $10.40. 232 pages.

THE POSITION AND STATUS OF RESEARCH WITHIN THE MARKETING FUNCTIONS OF THE SHOE MANUFACTURING INDUSTRY

(L. C. Card No. Mic 59-899)

George Lloyd Herpel, Ph.D.
St. Louis University, 1958

An historical analysis of the training and experience of top administrative personnel of American industrial corporations reflects the significant problems of the time and foreshadows the types of information needed for decision-making. Within the past few years there has been a large scale implementation of the marketing management concept, a recognition that a marketing executive is vital as a member of the administrative team, that all decisions must be integrated in order to achieve two objectives--profitable scales and increasing satisfactions for the customer.

Coincidental with the growth of the marketing concept, there has been an awareness of a need for more marketing research data to aid in integrated decision making for determination of over-all corporate objectives, formulation of policy, visualization of effective market strategy, data for day-to-day operations, development of standards of control, and considerable background to understand the object of the marketing process--the ultimate consumer. The shoe manufacturing industry has belatedly made a start in the development of its executive personnel and enlargement of its research facilities.

In an effort to assess marketing research in relation to this industry, the practices of 162 companies were reviewed by means of a formal questionnaire. A selected number of representative progressive organizations was singled out for more intensive study through personal interviews. Specifically, an attempt was made to find out what research was being done, the application of collected data, and the organizational unit to perform the research function. The 162 companies surveyed represented an estimated twenty per cent of the total operating companies of the industry, and over one-third of the total industry dollar production.

The most obvious finding of the survey was the small number of companies who are using marketing research and the restricted areas in which they are gathering data. The most common types of activities are research on competitive products and methods, and sales analysis to determine market potentials and delineation of sales areas for quota setting and territorial assignment. Other research involves sales forecasting, operating data regarding independent, franchised and company owned outlets, and the effectiveness of packaging and sales promotion.

Virtually no research is being done on the larger issues facing the industry: how to utilize more advantageously its reserve and excess capacity, how to stem the decline in per capita consumption and the associated down-grading in quality of consumer purchases, how to increase the low profit return on even the most profitable operations. There is an awareness on the part of respondents that distribution cost analysis could probably turn up data to show the way to increased profitability, but no suggestions were offered on how to increase per capital consumption or how to utilize effectively excess and reserve capacity.

Before any considerable amount of research will materialize, two handicapping attitudes must undergo a change. There is a prevalent belief that the shoe industry is entirely a price industry and that the only way to meet competition is to increase the efficiency of production. The second encumbering attitude is that shoe consumption is entirely a function of population, therefore there is little that can be done to increase per capita sales.

However, progress is being made. Forward looking companies are anticipating more research. Moves are being made to establish adequate research departments, to install electronic computing equipment to analyze market data, and to share costs of industry wide basic research. There is industry wide cognizance too that research should be a staff function which will contribute to the decision-making of major executives.

The success of the marketing research function in the shoe manufacturing industry depends on two factors: (1) Effective indoctrination concerning the values stemming from marketing research, how to use it, and how to make it a by-product of one's day-to-day work in relating cause and effect. (2) Insight on the part of the researcher into management's problems, and imagination and skill in setting up probing projects which will yield needed and satisfactory answers to the solution of company problems.

Microfilm $2.90; Xerox $10.00. 224 pages.

MARKETING PRACTICES OF NEWLY ORGANIZED LIFE INSURANCE COMPANIES

(L. C. Card No. Mic 58-3361)

Arthur W. Mason, Jr., Ph.D.
University of Pennsylvania, 1958

Supervisor: Dan M. McGill

The general purpose of the dissertation is to present a comprehensive study of marketing practices of life insurance companies during the five-year period following organization. Thus, all companies examined had survived the five-year period. This does not mean all were successful. The companies incurred varying degrees of success.

The emphasis on marketing procedures does not exclude consideration of financial problems. Many decisions

which directly affect marketing procedures are related to financial problems. Whenever such a situation exists, the relationship between financial problems and the resulting marketing procedures and practices is considered.

The conclusion reached is that the factors influencing survival or failure of newly organized companies, from a marketing viewpoint, divide themselves into objective and subjective ones. The objective factors can be readily appraised by persons in reaching decisions on whether to organize a new company, whereas the subjective factors cannot be evaluated until the company has been in operation for several years. If the situation is not favorable to all factors, the chances of survival, and perhaps success, have been weakened.

The objective factors are (1) financial resources, and (2) experienced personnel. When adequate quantities of both are available, the company has an excellent chance of developing into a successful and thriving company.

These factors establish limits within which management selects marketing practices. The amount of funds suggests the maximum amounts that can be spent on various activities including employment of experienced personnel. The experience of management gives an indication of the knowledge that can be drawn upon to provide efficient and effective operation.

The financial resources of a new company which commences with no insurance in force are capital and surplus. These support the operations until adequate income becomes available, which may not occur for several years. The funds, being inadequate in most cases, cause marketing practices to be evaluated in terms of their income producing ability immediately. Long range planning, as a result, is seldom undertaken.

Generally a change in management of a company comes about as a result of the inability of those organizing a company to operate it profitably. Several persons knowing very little or perhaps nothing about the over-all operation of a life insurance company organize one. Shortly thereafter, they learn they cannot compete with other companies in the sale of life insurance because of their lack of knowledge and are replaced and sell their interest in the company.

The subjective factors, although outside the scope of the study, are briefly mentioned.

For the purpose of dealing with companies having similar characteristics and problems, the study was confined to some of the legal reserve life insurance companies licensed between the dates of January 1, 1925, and December 31, 1949, and writing ordinary life insurance. The companies were examined so as to determine the nature of, reasons for, and success of their portfolio, agency operation, underwriting practices as they effect marketing of life insurance, and expansion activities. The portion of the dissertation on policy portfolio deals with the forms of life insurance sold, the use of special policies, and the basis for premium and reserve calculations. The discussion of the agency operation includes the agency systems used, selection and training of agents, and agency compensation plans. Included in the presentation of underwriting practices are the negotiations of a reinsurance treaty, establishment of age limits within which insurance is sold, rules for writing substandard insurance, and limits within which non-medical insurance is written. The material on expansion activities is limited to a discussion of the extent to which new companies enter additional states and reinsure other companies.

Microfilm $3.85; Xerox $13.00. 297 pages.

A STUDY OF ACCOUNTING EDUCATION IN SENIOR COLLEGES AND UNIVERSITIES OF THE SOUTHERN ASSOCIATION OF COLLEGES AND SECONDARY SCHOOLS

(L. C. Card No. Mic 59-1115)

H. Earle Reese, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: William H. Vaughan

The purpose of this study was to determine the status of accounting education in higher educational institutions of the South, compare practice with selected norms, and make recommendations to decrease disparities among accounting programs, thus contributing to the improvement of accounting education in the area.

Data concerning the 193 members of the Southern Association of Colleges and Secondary Schools were derived from two main sources. The 1957-1958 official college catalogues were the origins of data regarding accounting course offerings and programs; heads of departments supplied information related to professional training and experience, through the medium of a questionnaire.

Standards promulgated by the Standards Rating Committee of the American Accounting Association were chosen as being appropriate for use in this study, especially in respect to norms for the accounting curriculum, the accounting staff, and related administrative factors.

Findings of the Study

The study revealed disparities in the naming, numbering, describing, and mechanical presenting of accounting courses in the official college catalogues of the 193 surveyed schools. Over 400 different names were given to the courses offered; however, there was modal grouping around certain nomenclature that indicated the possibility of standardization. There was evidence of proliferation in accounting course offerings in some institutions in the area.

The study disclosed a lack of uniformity among major accounting schools as to requirements in the areas of accounting, other business courses, and non-business courses. As a group, the requirement in accounting courses was significantly below the recommended 25 per cent of the Standards Rating Committee; the major schools required considerably more in the non-business area than the 50 per cent that was suggested. Deviation from the norm for other business courses was not so pronounced.

There appeared to be substantial agreement between practice related to graduate programs in accounting and the standards of the committee. There was, however, utter lack of uniformity as to classification of courses available to graduate students, the variety of courses offered, and requirements for the degrees.

Accounting instructors in the area did not conform to

the professional training requirements of the committee partially because of the utilization of a significant number of part-time instructors by the larger institutions. The percentage of faculty members holding the doctorate and the master's degree was below that of business teachers in member schools of the American Association of Collegiate Schools of Business. In respect to responsible professional experience, however, almost three-fourths of the accounting instructors in the area had one or more years of such experience. Staff members in general were permitted to engage in outside professional activities although the majority of institutions did not encourage such practice.

It was recommended that efforts be made to achieve uniformity in catalogue presentation of accounting courses, using the nomenclature and numbering systems that appear to be typical in the area. Generally, major schools need to increase their requirements in accounting and to decrease requirements in the area of non-business courses. There was also the recommendation that a re-appraisal be made of the other business and non-business courses now a part of the accounting curriculum with a view toward including courses in industrial management, production, statistics, and public speaking, and the elimination of some of the skill subject requirements.

Microfilm $3.45; Xerox $11.60. 265 pages.

OFF-LIST SELLING OF ELECTRICAL APPLIANCES IN THE METROPOLITAN ST. LOUIS MARKET, 1947-1956

(L. C. Card No. Mic 59-917)

Richard C. Reidenbach, Ph.D.
St. Louis University, 1958

Since the end of World War II, off-list retail outlets have grown tremendously, becoming a threat to traditional retailers. This has been especially true in the selling of household appliances. Estimates indicate that, throughout the nation, possibly ninety-five percent of all household appliances have been sold at discounted prices. The St. Louis market area has not been immune to increasing price competition. Rather, competition has been heightened by the increased activities of large-scale-advertising price cutters to appropriate a larger market share. During the years following the war, the proprietors of discount houses - a new type of price institution - saw an opportunity to appeal to a growing price-conscious market on the basis of smaller operating margins, making further inroads upon the share of traditional retailers, forcing them in turn to meet the new growing competition with the same competitive weapon - price.

This dissertation attempts to measure the effects of off-list selling in the metropolitan St. Louis area, and to analyze and evaluate the price changes and volume shifts caused by this type of competition. To accomplish this purpose, data are presented to answer the following questions: What competitive strategy was employed by various retail outlets actively engaged in attempting to retain or regain their market shares? What were the changes in the attitudes of the buying public and in their buying practices as a result of increasing price appeals? Since the announced policy of the St. Louis department stores to combat off-list appliance retailers, what has been the resultant effect upon their gross margins? How has competitive pricing by traditional outlets affected their volume? Have services such as delivery, short term credit, and return privileges regarded as essential to many customers suffered from competitive pricing?

Outlets, classified by basic methods of doing business, have demonstrated an ability to sell to a well defined market segment, and their competitive strategy, centering around patronage motives, to maintain a differential advantage in the past, has been successful. However, price has always been a major weapon of competition, indicating that St. Louis merchants have been rather unique in their thinking that total profits are the result of total sales rather than maintained margins, and that to some extent the appliance market is elastic. Merchants, in order to remain competitive, have reduced their maintained margins on major appliances from 15 to 21 per cent and have reduced the same margins on small appliances from 10 to 15 per cent. With the advent of the discount houses, price consciousness seemed to be universal; therefore, the decision of the department stores to compete on a price basis has proved to be a sound one, and as a result, they as a group, have been able to hold their share of the market. In many cities the department store has become the minor factor in the appliance market by refusing to compete on a price basis, thereby losing volume to the discount operator.

Today the market is characteristically a price market. Because of reduced retail margins on most household appliances, a large amount of price stability has been the result in the market. Traditional outlets have not curtailed their services, preferring to compete on a price plus patronage basis. Shifts away from traditional outlets, except from the small independent retailers, have been halted. The small retailer seems to have borne the brunt of the price war and in order to survive is turning to service and repair revenue to supplement sales income.

Nationally, on the part of the manufacturer, there has been a recognition of exaggerated list prices; hence, suggested margins have been reduced, central service is diminishing, which had a tendency to encourage price cutting. In the retail field discount outlets are becoming orthodox and are offering a limited amount of service.

Looking into the future it seems rather certain that price stability in the St. Louis market will exist for some time; however, traditional outlets may be able to sell at a slight premium price in a price market by stressing the advantages of necessary service. Evidence indicates that demands will be made on the part of the retailers to limit the number of total retail outlets in the market to maintain what is considered necessary price stability and satisfactory service. On the part of the consumer, evidence indicates that the discounting era has had its effect, and that to a large extent when people shop for appliances they take discount house prices as a basis for comparison.

Microfilm $3.25; Xerox $11.20. 250 pages.

AN INVESTIGATION OF PROFESSIONAL MANAGEMENT EDUCATION

(L. C. Card No. Mic 59-1410)

James Robert Schaefer, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Erwin A. Gaumnitz

This investigation deals with the nature of and the philosophy behind the education offered by American collegiate schools of business as preparation for the profession of management. The phrase "profession of management" refers to that group of positions in modern industry open to graduates of schools of business at the undergraduate and graduate level, positions whose holders deal with the problems of planning, directing, and controlling both the inanimate tools of the modern business world as well as the human beings in direct charge of these tools. It refers, in short, to what is ordinarily called the management of production and personnel.

The purposes of the investigation were threefold: to learn of the present practices of collegiate schools of business in education for management work, as well as the philosophy behind these practices; to determine the opinions of men and women presently members of the management profession on such education in colleges and universities; and to draw conclusions as to the present and future status of this management education.

After a brief resume of the development of the management education programs at a typical collegiate school of business (the University of Wisconsin's School of Commerce), the investigation reports the result of an intensive survey of the practices of all the schools which are members of the American Association of Collegiate Schools of Business, practices concerned with professional management education. This information was gleaned from the descriptions in these institutions' bulletins and from personal letters to the writer from the deans of the schools. From these personal communications it was possible quite adequately to survey and summarize the philosophy behind the practices of the various schools; such description and summarization of philosophy accompanies the description of the practices. Both undergraduate and master's degree programs were surveyed and are discussed.

A second study is also included in this investigation, that of the opinions of personnel management executives at practically all of the industrial firms, each having two hundred or more employees, in the greater Milwaukee area. The opinions are on the subject of what these people consider adequate college preparation for management positions, as well as the nature of the college education they desire and demand in business school graduates they hire.

Four basic conclusions were reached by the writer on the basis of the investigation:

1. At least one course in the general field or in the specific areas of management should be required of all graduates of a collegiate school of business.
2. Only one major field of concentration in management should be offered by a school of business, to include all the areas of that field.
3. The curriculum for this single management major should be quite rigidly fixed, most of its constituent courses being absolute requirements.
4. There is a place for two distinct types of master's degree programs: the first, a broad, general course of study, with little or no concentration in a single field as management; the second, a narrow, specific course of study, centering on a single business field.

Microfilm $2.95; Xerox $10.20. 228 pages.

ECONOMIC THEORY AND ACCOUNTING PRINCIPLES: A STUDY OF PRINCIPLE-PRACTICE RELATIONSHIPS BETWEEN THE THEORY OF PRODUCTION AND BUSINESS ACCOUNTING

(L. C. Card No. Mic 59-585)

Robert Gene Stevens, Ph.D.
University of Illinois, 1958

It was the objective of this study to develop and test the hypothesis that the economic theory of production provides a systematic statement of principles through which the accountant may provide data useful for the management of economic resources in a business enterprise. The first part of the study was concerned with the reasonableness of this hypothesis and its implications for accounting. In order to test the hypothesis, the theory of production was analyzed. Next, accounting practices in the areas of planning, control, and income determination and the general ideas of operations research were compared with the theory to determine whether these developments could be duductively derived from the postulates of the theory of production.

The evidence presented in the study revealed that the theory of production is not a body of fundamental principles such as those which might be found in the physical sciences, but the theory is scientific in the sense of the scientific method. At its conceptual base, the theory contains a body of postulates which have proved, if not to be true, at least to be a reasonable approximation of the decision-making processes of the real world. It has been found that many precepts and practices of accounting fit the postulates of this theory. These accounting practices, however, provide only an elementary framework for decision-making. The developments in operations research, on the other hand, prove that the marginal analysis of production theory provides a coherent, consistent, and logical framework for decision-making when it is adjusted for the complications of the real world. Since a conceptual base identical with that of production theory has provided a logical foundation for the practices and techniques of operations research, it is reasonable to conclude that this same conceptual base could also provide a foundation for control accounting and income determination. Consequently, it is possible to develop a principle-practice relationship between production theory and accounting.

At the present stage of development in accounting, a formal principle-practice relationship does not exist between accounting and the theory of production or, presumably, any other theory. The precepts and practices of accounting represent the exercise of good judgment, but these precepts and practices have not been the conclusions of a careful application of the scientific method. The entire process has taken place at the intuitive level. Consequently, all of the practices of financial accounting, as one

example, do not fit the same body of postulates. There are inconsistencies and conflicts of purpose. So long as judgment in accounting is applied directly to the development of precepts these deficiencies are not likely to be resolved. In both production theory and operations research, judgment is applied at a more fundamental level --the level of postulates. The rest of the structure, then, is deductively derived from this foundation of postulates. Errors can be made in logic, but these are subject to examination because of the nature of the scientific method. Errors in judgment are isolated to one place in the pattern rather than compounded throughout its whole structure. Production theory offers a foundation which could be used to make all the areas of business accounting into a consistent, rational, logical structure. The scientific method offers a means for developing any kind of accounting structure from any generally accepted conceptual framework.

Microfilm $3.30; Xerox $11.40. 256 pages.

ECONOMICS, FINANCE

AN EMPIRICAL TEST OF GUIDES TO THE SELECTION OF INDUSTRIAL COMMON STOCKS FOR INSTITUTIONS

(L. C. Card No. Mic 59-1248)

Stephen Hunt Archer, Ph.D.
University of Minnesota, 1958

Chairman: Professor Ben B. Sutton

The problem confronting some financial institutions and perhaps more in the future, should their investments in common stock expand, is one of finding guides to the selection of stock issues. As institutions are usually able to diversify over many issues, the task of selection could be reduced to selection of some group or groups of issues with a common characteristic upon anticipation of results for the group as a whole better than could be secured by random selection.

The approach to the problem was to test potential selection guides empirically for their association with investment performance. The investment performance of each of over four hundred issues was measured as stock price appreciation plus dividends, both adjusted for stock dividends, stock rights, and stock splits for three time periods.

The particular guides, or characteristics to be compared to investment performance were selected on the basis of their significance as generally regarded in investment literature and/or their expected influence on the dependent variable. These factors were: (1) the percentage of earnings reinvested in the five years prior to the investment performance period, (2) the size of the company within its industry as ranked on a common-sized basis according to total assets in the base year of the investment period, (3) the ratio of earnings to price in the base year, (4) leverage in the financial structure as measured by the percentage of long term debt to total long term debt plus net worth, and (5) projection, the influence of five years' investment performance on its future performance.

Multiple, R, partial, r, and simple correlation coefficients were calculated to determine the weight, if any, of the association of the independent variables with investment performance.

Table I
Multiple Correlation

Time Period	R	Ninety-nine Per cent Confidence Limits	R^2
1940 to 1955	.46	.34 to .57	.21
1945 to 1955	.28	.16 to .40	.08
1950 to 1955	.22	.09 to .34	.05

Although the coefficients in each time period were significant, the coefficient of multiple determination, R^2, indicates that the five independent variables explained only five per cent of variance in the dependent variable in the third time period.

Table II
Partial Correlation

Independent Variable	Time Period	r	Ninety-nine Per cent Confidence Limits	r^2
Per cent	1940 to 1955	.11	-.03 to .26	.01
Earnings	1945 to 1955	.11	-.02 to .24	.01
Reinvested	1950 to 1955	.06	-.07 to .19	.00
Size	1940 to 1955	-.14	-.28 to .01	.02
in	1945 to 1955	.06	-.08 to .19	.00
Industry	1950 to 1955	.06	-.07 to .19	.00
Earnings-	1940 to 1955	-.35	-.48 to-.22	.12
Price	1945 to 1955	.09	-.04 to .23	.01
Ratio	1950 to 1955	.11	-.02 to .24	.01
	1940 to 1955	.28	.15 to .42	.08
Leverage	1945 to 1955	.09	-.04 to .22	.01
	1950 to 1955	.03	-.10 to .16	.00
	1940 to 1955	-.01	-.15 to .14	.00
Projection	1945 to 1955	-.05	-.18 to .08	.00
	1950 to 1955	-.05	-.18 to .08	.00

The influence of the independent variables acting individually on the dependent variable illustrates that the variables of projection, size of the company, and per cent of earnings reinvested explained negligible amounts of variance in the dependent variable. In the longer time period, significant partial correlations existed for the leverage and earnings-price ratio variables, but even here the proportion of the variance explained was not large.

These results tend to suggest, but not prove, the lack of association of three of the independent variables; and the significant correlation of the other two variables only suggest the desirability for further and more extended investigations over many different time periods.

Microfilm $4.80; Xerox $16.00. 373 pages.

CAPITAL ALLOWANCES AND THE CONCEPT OF INCOME: A STUDY IN BRITISH TAXATION

(L. C. Card No. Mic 59-1381)

William Bruce Bentsen, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Harold M. Groves

British tax treatment and the history of tax changes with respect to depreciation, depletion, and other capital allowances are examined in the light of the "flow" concept of income. The basic thesis defended is that current tax law relating to capital allowances (as well as to capital gains) shows the strong influence of this type of income concept, either directly or indirectly. Historical analysis indicates that almost all changes toward recognition of the accrual or "economic power" income idea have come via administrative concessions or judicial decisions. Besides depreciation, other types of capital items and their treatment are considered; also included are lease-premiums, patents, copyrights, and the capital element in an annuity. Legal interpretation is shown to have played an especially prominent role in treatment of all of these.

Alternatives to the income-concept thesis are examined, and some are accepted as supplementary factors. These are the low rates of tax prior to World War I, a delay in development of accounting techniques, the fact that for years the income tax was considered to be only temporary, problems connected with the collection process (deduction-at-the-source), and the conservativism and authority of the Department of Inland Revenue. Another thesis examined is that the tax is essentially a property tax, but this seems an unsatisfactory view. An additional factor, developed later, is the difficulty in treating companies and individuals alike.

Some tax policy implications are discussed, and the economic power concept is defended as the best measure of taxable income. Such a concept calls for the amortization of any capital sum over the period of time to which it applies. Judged in this light, present British tax law is seen to suffer from inconsistencies, arbitrariness, and failure to achieve intended goals. The difference in treatment between individuals and companies is considered necessary to the practical application of a theoretical income concept. Included also is a discussion of the use of the tax mechanism to stimulate investment, and various methods are examined, on the assumption that such use is a political reality. Microfilm $2.95; Xerox $10.20. 228 pages.

ECONOMICS, THEORY

PUBLIC AGENCIES AND ECONOMIC DEVELOPMENT IN BRITISH WEST AFRICA, 1947-1955

(L. C. Card No. Mic 58-3312)

David Edward Carney, Ph.D.
University of Pennsylvania, 1958

Supervisor: Dr. Irving B. Kravis

This study appraises the experiments of the British West African Governments in the use of public agencies for the purpose of stimulating economic development during the period 1947 to 1955. The agencies studied operate commodity marketing schemes, industrial projects, social welfare schemes and public utilities.

A broad outline of the economy is presented in Part I through the familiar national income and product approach, linked with capital formation, employment, production and external trade, public finance, currency and banking.

Part II continues the story with a historical summary of the origins and objectives of the various public agencies and the circumstances surrounding the growth of state economic intervention in recent years.

In Part III the operations and financial results of the various agencies are summarized, followed by an evaluation of the economic activities of each agency in Part IV.

The study indicates that some investment has been made by all the agencies, and that the commodity marketing boards have been unique in accumulating large cash balances. This has in part been an almost inevitable consequence, in a period of high commodity prices, of their function of price stabilization through the monopoly purchase and foreign marketing of domestic crop production. The accumulation was achieved while other agencies, notably the public utilities in Nigeria and the Industrial Development Corporation in Gold Coast, were short of funds for investment.

The marketing boards and related agencies were hampered in the development of other produce by laws restricting the use of their funds to the benefit of the agricultural sector contributing the particular products marketed by the boards. While the agencies themselves were thus restricted, the respective governments found ways to tax or borrow funds that might have gone or actually did go to the boards.

All public agencies were held back in their general objective of stimulating economic development by certain basic deficiencies: lack of basic knowledge of available resources, local skills, capital and foreign exchange other than sterling.

The conclusions reached on the basis of this study are chiefly the following:

(1) The public utilities have been incurring losses but need to put their deficits in perspective as a subsidy or benefit to other segments of the economy.
(2) The commodity marketing boards, the most important in terms of available resources, have not made much contribution to West African economic development in terms of investment actually undertaken. All of them combined have spent no more than 26 per cent of their accumulated funds on direct or intended investment during the period of reference. The effect of their

sterling accumulation policy on crop output, though debatable, is likely, on the whole, to have been restrictive.

(3) Without the commodity marketing boards the pattern of investment would have been different. If their accumulated funds had then gone to the producers, without interception by the expatriate oligopolies that previously dominated the external trade of West Africa, private investment would probably have been substituted for that by the boards; the amount depending on the available inducement and the willingness of the producers to invest.

(4) Apart from being used for price stabilization, the funds of commodity marketing boards are being increasingly diverted towards general economic development, or general expenditure, by the various governments, at the expense of the export crop producers whose level and future stability of income are adversely affected by increased taxation of the products marketed by the boards. Producers suffer also because the funds are diverted from development expenditures specifically designed to aid their industries, one of the uses of the funds that had been originally intended.

Microfilm $3.35; Xerox $11.40. 258 pages.

A BARGAINING MODEL FOR THE COOPERATIVE n-PERSON GAME

(L. C. Card No. Mic 59-1439)

John Charles Harsanyi, Ph.D.
Stanford University, 1959

Supervisor: K. J. Arrow

A bargaining model is presented with the view of defining a determinate "solution" for the cooperative n-person game; i.e., defining a set of payoffs that represent the equilibrium outcome of bargaining among rational players. The solution furnished by the model is a direct generalization of Nash's solution for the cooperative two-person game. It can also be regarded as an extension, to games without transferable utility, of a modified version of the Shapley value.

The model is based on the assumption that all possible subsets of the players (these player subsets are called "syndicates") will cooperate in protecting their common interests against the rest of the players. In contrast to the von Neumann-Morgenstern theory, where each player can be a member of only one "coalition," in this model each player will be a member of 2^{n-1} different syndicates.

More specifically, it is assumed that each syndicate publicly guarantees certain payoffs, called "dividends," to its members. Each player's final payoff will be the sum of all dividends guaranteed to him by the various sectional syndicates and by the all-player syndicate. Each sectional syndicate also announces a "threat strategy"; i.e. a joint strategy that the members of the syndicate would follow against the rest of the players in case they could not agree with them on the distribution of final payoffs. The dividends and threat strategies of each syndicate are decided by bargaining among its members.

Hence the bargaining position of every player depends on the results of bargaining within other syndicates. Thus the outcome of the game is determined by a complex network of agreements among the players. These agreements have to satisfy certain equilibrium conditions of mutual consistency and interdependence. By virtue of these equilibrium conditions the model reduces the cooperative n-person game to a $(2^n - 1)$-person non-cooperative game played by the $(2^n - 1)$ syndicates.

In certain cases, e.g. for games with transferable utility, these equilibrium conditions uniquely determine a set of equilibrium payoffs. But in general there may be an infinite number of alternative payoff vectors satisfying these conditions. It is assumed that in such cases the actual payoffs are determined by a further round of bargaining among the players. Under this last assumption the model always defines a unique solution for any cooperative game.

In the special case of games with transferable utility, the solution furnished by the model is a modified form of the Shapley value. The Shapley value in its original form is based on the von Neumann-Morgenstern characteristic function, which implies the assumption that in case of a conflict each side would use a strategy associated with the maximin of its own joint payoff. In contrast, our solution is based on a different characteristic function, corresponding to the assumption that in the case of a conflict each side would use a strategy associated with the maximin of the difference between its own joint payoff and the other side's joint payoff.

The solution defined by the model can be applied in the analysis of a number of economic, political and other social situations, such as many-cornered individual and collective bargaining; oligopoly; the distribution of income and power among several social groups; the balance of power in international politics, etc.

Microfilm $2.00; Xerox $3.80. 66 pages.

EDUCATION, GENERAL

RELIGIOUS CONTENT OF FREQUENTLY USED UNDERGRADUATE PROFESSIONAL EDUCATION TEXTBOOKS

(L. C. Card No. Mic 59-1085)

Milas McCord Ayers, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: William H. Vaughan

The purpose of this study is to determine what information certain professional education textbooks used by teachers in training offer on the subject of the teaching of religion in the public schools. An analysis will be presented of the spatial emphasis in each textbook, and a summary will be made of what is said on the subject in the textbooks examined.

Procedure

A study of the requirements for teachers' certificates as outlined by the departments of education of the forty-eight states determined the ten courses or areas most often required or suggested for teacher certification. Twenty-one textbooks most often listed by 212 colleges of the American Association of Colleges for Teacher Education as adopted texts in the ten areas from the basis of this study.

Spatial Analysis

1. The authors of the textbooks seem, to a large degree, to disregard the teaching of religion in the public schools, perhaps, thinking it not properly a part of teacher training.

2. The textbooks most widely used have least emphasis upon the subject of the study. The seven textbooks in the two areas most often required for certification make no mention of the subject. The twelve textbooks in areas 1 to 5 give only seventy-four lines. The eight textbooks most often mentioned by the colleges have only 117 lines on the subject. The textbooks under Guidance have no material, and the two under Elementary Curriculum contain only thirty-three lines.

3. The greater portion of the space devoted to the teaching of religion in the public schools is found in those textbooks less often used in teacher training. The three textbooks in Philosophy of Education and Educational Sociology contain 702 lines, or 71.6 per cent of the total 980 lines found in the twenty-one textbooks. Brown's Educational Sociology, in the tenth area, has 498 lines, 50.8 per cent of the total emphasis in the books examined.

4. The histories of education have only eighty-four and eighty-seven lines respectively in the area of our study, giving little emphasis to current thinking and practices in the teaching about religion.

5. Eight of the twenty-one textbooks devote some space to a discussion of the teaching of religion in the public schools. Thirteen books make no contribution to the subject, though eight of the thirteen do have chapter titles, subtitles, pictures, charts, graphs, or illustrations emphasizing some other aspect of religion. Five of the textbooks do not mention religion and its place in the education of children.

6. In the twenty-one textbooks, there is a total of twelve chapter titles, twenty-nine subtitles, thirteen pictures, eighteen charts, two graphs, and two illustrations with some reference to religion in education.

The Current Situation

1. Public school administrators recognize the teaching of morals, ethical character, and religions as proper school aims to be taught incidentally in the school program.

2. The religious educator maintains that morals are from God and cannot be adequately taught apart from religion.

3. The public schools have a direct responsibility for the development of spiritual values, but it is the proper function of the school to support and reinforce the home and the church in this important obligation.

4. It is mainly through the example of the teacher that moral and spiritual values are best taught.

5. Some improvement should be made in approaches to teaching about religions in the classroom.

Microfilm $2.00; Xerox $5.60. 113 pages.

FACTORS ASSOCIATED WITH THE COLLEGE ATTENDANCE PLANS OF FLORIDA HIGH SCHOOL SENIORS

(L. C. Card No. Mic 59-476)

Myron Roy Blee, Ed.D.
University of Illinois, 1958

This study was concerned with the associations between (1) each of a number of factors and (2) certain plans respecting college attendance that were reported by Florida high school seniors. Four categories of factors, viz., individual-personal, family-related, school-related, and community factors, were studied in relation to three aspects of college attendance plans, viz., either to attend or not to attend college, (if college-bound) either to defer or not to defer entry into college, and (if a college had been selected) to attend either a Florida or non-Florida institution. The students involved were 3,164 white and 711 Negro seniors who constituted two racial samples drawn on the basis of a stratified random sampling technique so as to be representative of the seniors in the public high schools of Florida in 1955.

The general design of the study was (1) to make chi square tests to determine the significance of the association of the factors with the students' college attendance plans, and (2) for those associations which were found to

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

be significant at the .02 level of significance, to compute coefficients of contingency from the chi square data to indicate the extent of the relationships in question.

The factors that were found to be significantly associated with the plans of the seniors either to attend or not to attend college were listed according to the size of the coefficients, which ranged from .55 to .05 for the white and from .39 to .05 for the Negro seniors. Principal factors were identified and some interrelationships among them were examined. It was concluded that those seniors who were highly motivated to go to college, whose occupational goals would be served by college attendance, who were confident that they could succeed in college, who believed that their families wanted them to go to college, and who planned to defer their marriage for at least four years after their graduation from high school were those who were the most inclined to plan to attend college.

The coefficients of contingency that were obtained to express the extent of the relationships between each of the factors and the plans of the college-bound seniors either to defer or not to defer their entry into college ranged from .36 to .06 for the white and from .36 to .12 for the Negro seniors. It was concluded that those seniors whose occupational goals would be served by college attendance, who were highly motivated to go to college, and who ranked high in their graduating classes, were those who were least inclined to plan to defer their entry into college.

No coefficient greater than .25 was found to express the extent of the relationship between (1) the plans of the college-bound seniors to attend either a Florida or non-Florida institution and (2) the limited number of factors for which the association was significant. It did appear, however, that those students who had high academic ability, who intended to prepare for a profession, and who were highly motivated to attend college, were the most inclined to select a college or university that is located elsewhere than in the State of Florida.

Microfilm $2.30; Xerox $8.20. 176 pages.

A LONGITUDINAL STUDY TO DETERMINE THE STANINE STABILITY OF A GROUP'S TEST-SCORE PERFORMANCE IN THE ELEMENTARY SCHOOL

(L. C. Card No. Mic 58-3890)

John E. Corcoran, Ed.D.
Boston University School of Education, 1958

Purpose

The major purpose of the study was to analyze the seven-year test results of a group of 336 elementary-school pupils to determine the stability of the group's test-score performance in ability, in achievement as related to ability, and in achievement as related to previous achievement. An allied purpose was to evaluate the use of stanines in this kind of study.

Procedure

Ability and achievement subtest scores were made comparable by normalizing local distributions into stanine scores by means of the Otis Normal Percentile Chart. 27,530 test scores of 895 pupils were processed. For each year, stanine scores of the staying population of 336 were compared; consistencies and variations determined; results tabulated; trends and patterns evaluated.

Findings

Consistency in ability.--From second to fifth grades, 77 percent varied in ability two-or-less stanines; 56 percent varied one-or-less stanines; 20 percent showed no stanine variation.

From second to eighth grades, 78 percent varied two stanines or less; 54 percent varied one-or-less; 20 percent, no variation.

From fifth to eighth, 86 percent varied two-or-less stanines; 64 percent varied one-or-less; 28 percent showed no variation.

Consistency in ability and achievement.--Achieving within two stanines of ability in second grade were 80 percent in both reading and vocabulary; 73 percent in both fundamentals and problems; 65 percent in spelling. Within a one-stanine limit, 53 percent were consistent in both reading and vocabulary; 46 percent in both fundamentals and problems; 40 percent in spelling.

Achieving within two stanines of ability at fifth grade percentagewise, were 88 in reading; 83 in vocabulary; 84 in fundamentals; 86 in problems; 85 in English; 85 in spelling. Within a one-stanine limit, were 65 percent in reading; 62 in vocabulary; 60 in fundamentals; 62 in problems; 65 in English; 58 in spelling.

Achieving within two stanies of ability at eighth grade, were 81 percent in reading; 84 percent in vocabulary; 84 in fundamentals; 85 in problems; 86 in English; 85 in spelling. Within one stanine of ability were 58 percent in reading; 61, vocabulary; 60, fundamentals; 59 in problems; 65, English; 60, spelling.

Consistency in achievement as related to previous achievement.--Almost three quarters of the staying population operated within one stanine of the previous achievement-test results in every grade for six years in reading and vocabulary. Ninety percent operated within two stanines. Spelling consistencies were in the high nineties from fifth grade through eighth.

Tentative Conclusions

The peak of stability in aptitude for school learnings was reached by fifth grade and sustained through eighth grade.

A long-range prediction of performance based on a group test of ability in the primary grades is generally less dependable than one in the middle grades.

Ability and achievement are more closely related at middle and upper levels than at the primary level.

Overachievement and underachievement in general are greatest at the lower levels except in reading and vocabulary.

Reading and vocabulary performances in any grade are excellent indicators of reading and vocabulary performances in the next grade.

Children's strengths and weaknesses in spelling appear to be sustained from fifth through eighth grades.

Children at all levels, in all areas, are very much less likely to deviate staninewise from prior achievement than they are from mental ability. This held true with rare exception during this entire longitudinal study.

Use of stanines.--The stanine technique permitted us to quantitatively compare pupil performance on any two tests. Despite certain weaknesses in the tails of the distributions, the adequacy, practicability, and simplicity of the stanine system commend it for use.

Microfilm $2.25; Xerox $7.80. 170 pages.

EVALUATION OF THE DRIVER EDUCATION PROGRAM AT MISSISSIPPI SOUTHERN COLLEGE AND MISSISSIPPI STATE COLLEGE

(L. C. Card No. Mic 59-1091)

William Lee Crabtree, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Solon Sudduth

The purpose of this study was to evaluate the Driver Education Program at Mississippi Southern College and Mississippi State College and from the data obtained make suggestions for revisions to strengthen the present teacher training program should the conclusions warrant such changes.

The critical incident technique of research was used for this study. The procedure consisted of interviewing teachers of driver education in the state of Mississippi, almost all of whom had graduated from either of the two above mentioned schools. They were asked to describe the most effective and least effective experiences they had observed in their teaching or had undergone while they were going to school preparing to be driver education instructors. By following the critical incident technique the incidents were categorized and placed in an outline, which consisted of three general and six major areas.

Findings and Conclusions

Five specific areas were found to be of major importance in the successful instruction of students in becoming safe and efficient drivers.

Proper driving equipment was frequently mentioned as being very important to the success of the course. Smaller schools were handicapped by not having the use of an automobile. The equipment needed to give the psychophysical tests was too expensive for several of the schools to obtain. They had to rely on outside agencies, namely the highway patrol and police officials for the needed material.

The time element in connection with the type of course the instructors took while in college was also noted as being of considerable importance. The short, one-week course, consisting of forty hours of instruction, was thought by many to be inadequate. Not enough time for practice driving was one of the chief objections.

Demonstrations and laboratory work constitute a very important phase of the program. Many students were better able to understand some of the problems after visual demonstrations. The highway patrol aided very much in presenting this type material. The psychophysical tests given to the students showed in realistic form many of the physical qualifications necessary to become a safe and efficient driver.

The teaching staff is important to any institution and the feeling existed that a larger staff at the two colleges would result in better trained driver education instructors.

The areas for giving the skill tests were generally considered inadequate. They were not clearly marked off and in some instances members of the class had to mark the course, using time needed for them to practice.

Schools located near the center of town had considerable difficulty finding suitable areas for administering their skill tests. Streets need to be blocked off for taking these tests and it was necessary in some cases to go five miles from school to find a suitable place.

In conclusion as to the effectiveness of the driver education program at Mississippi Southern College and Mississippi State College, the instructors interviewed were of the opinion that in most areas it is adequately meeting the needs of the students who are preparing to be driver education instructors.

Some suggested recommendations were: better equipment, improved instruction in administering the psychophysical tests, and additional classroom facilities. Also, more time should be alloted to driver skill and traffic tests. Instruction should be given in both standard and automatic shift cars. Another suggestion was that an advanced course be offered to keep the instructors informed on new practices and procedures.

Microfilm $2.60; Xerox $9.00. 198 pages.

AN ANALYSIS OF SEVENTH GRADE GENERAL SCIENCE CONTENT, AS EVIDENCED BY SELECTED COURSES OF STUDY AND TEXTS, IN TERMS OF THE PURPOSES OF THE JUNIOR HIGH SCHOOL

(L. C. Card No. Mic 59-980)

William Luckey Crocker, Ed.D.
University of Alabama, 1958

Chairman: F. L. Temple

The purpose of this study was to determine the extent to which the science program of the seventh grade as evidenced by the material and courses of study is in accord with the purposes of the junior high school. The program in any subject matter field should lend itself to and contribute to the accomplishment of the purposes of the school Therefore, the science content of the seventh grade texts and courses of study should be in accord with the purposes of the junior high school.

In order to determine the contribution of the seventh grade general science course to the purposes of the junior high school two things had to be determined. One of these things was the purposes of the junior high school and the other an outline of the general science course. The purposes were determined from the literature. They are:

1. Continue the development of the basic skills.
2. Make possible a gradual transition from elementary school to high school.
3. Assist pupils in making satisfactory mental, emotional and social adjustments in their growth toward wholesome, well adjusted personalities.

4. Provide for the preparation of the pupils to continue into high school and beyond.
5. Provide an integrating situation for developing the use of the skills, attitudes, interests, ideals and understandings which the pupils have.
6. Provide for an adequate counseling and guidance program suited for early adolescents.
7. Provide experiences in the acceptances of responsibility and self direction.
8. Aid in developing intellectual skills and concepts necessary for civic competence.
9. Provide exploratory work by enrichment, method, and administrative arrangement.
10. Aid in the development of an acceptable moral and ethical code.
11. Provide experiences of an aesthetic nature.
12. Aid the pupils in learning about the natural and physical environment and its effects on life and in having opportunities for using the scientific approach in the solution of problems.
13. Stimulate pupils to achieve their maximum potentiality, recognizing individual needs and interests.
14. Aid the pupils in developing a sense of the values of material things and on the rights and responsibilities of ownership.
15. Provide socializing experience, through social activities, group work, and other informal and organized situations.

The general science content was determined from systematic study of selected courses of study and text books. A composite outline was derived from these sources. The main topics considered were:

Learning and Behavior	Weather and Its Effects
Your Body and Growth	The Earth and Its Movements
Food	Astronomy
Your Senses	Rocks and Soil
Health	Fire and Its Uses
Alcohol, Narcotics and Tobacco	Matter and Molecules
Scientific Attitude	Light
Water	Sound
Air	Magnetism
Balance in Nature	Electricity
Plants	Changing Forms of Energy
Animals	Machines
Conservation	

The current topics were then subjected to a checklist of the purposes by the author and by a board of men recognized as authorities in the field of science together with men who have taught junior high school science. Substantial agreement was found between the opinion of the author and the selected board. Both the author and the selected board felt that each of the topics of content contributed in some manner to the fulfillment of the purposes. The degree to which this is true is to be found by an examination of the individual checklists in Chapter V and from Tables II and III at the end of the same chapter of the dissertation.

EXTENSION WORK IN BRAZIL AND SUGGESTIONS FOR ITS FURTHER DEVELOPMENT

(L. C. Card No. Mic 59-1191)

Ella Mae Crosby, Ph.D.
Cornell University, 1958

The Problem

Extension and supervised credit programs have been expanding in Brazil since early 1949. This study is a report of how public and private organizations joined together their resources to help the rural people of Brazil improve their standard of living. Brazilian extension and credit organizations are unique in that public and private funds are combined to operate them. They combine both the extension and credit phases of the program into the same organization.

The physical characteristics of the country are described as well as the characteristics of the people such as their education, health standards, their social customs and their major problems in agriculture and homemaking. This has a bearing upon the acceptance of these programs of extension and supervised credit.

The establishment and organization of municipio offices in new areas of Brazil are presented along with some explanation of the duties and responsibilities of the United States Technical Advisers to these extension and supervised credit programs. The municipio extension program in new areas of Brazil was analyzed with attention being given to the plan for involving people in program development, procedures in program development, the annual plan of work, and municipio extension program, program execution and evaluation of extension accomplishments.

Data Used in the Study

The purpose of this study was to assemble ideas and opinions of professional extension workers found in research and reports which might have application to the further development of extension work in Brazil. The main sources of data were the Brazilian official census, the offical contracts, annual reports, annual plans of work and studies from the various extension and credit organizations of Brazil and the literature of extension in the United States.

Treatment of the Data

The data are reported as found in the reports and other sources. No attempt was made by the writer to make an evaluation of the different extension and credit programs throughout Brazil.

Conclusions

This section was confined to major conclusions drawn from this investigation of the literature. The order of presentation is the same as that followed in the presentation of the problem.

Microfilm $2.80; Xerox $9.60. 213 pages.

THE SOCIAL POSITION OF HEARING HANDICAPPED CHILDREN IN THE REGULAR GRADES

(L. C. Card No. Mic 59-1095)

Roger Pitkin Elser, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Erick Lindman

The purpose of this study was to compare the social position of hearing handicapped children with that of normally hearing children who were members of the same classes. The investigation was designed: (1) to provide a better understanding of group structure and group behavior under the above-mentioned conditions, (2) to provide data which would have implications for educational procedures, (3) to indicate areas for additional research.

The null hypotheses tested were that no significant difference would exist between groups of hearing handicapped and normally hearing children in respect to: (1) the sums of their status scores, (2) their friendship scores, (3) their reputation scores, (4) the accuracy with which they perceive who would choose them as friends.

Procedure

A "test" requesting three responses to each of twenty-four questions was used to obtain the data. To determine friendship patterns, three acceptance and three rejection sociometric questions (friends, playmates, and lunchroom associates) were designed. To measure class acceptance a modified form of the Tryon "Reputation Test" was used. To determine how children perceive themselves in the social situation, two acceptance and two rejection questions about friends and playmates were used.

The criteria for selection of subjects were: (1) white children of rural Tennessee with hearing losses in excess of 35 db in the speech range; (2) age nine through twelve inclusive; (3) member of the class during the past seven and a half months.

When the data were obtained in April and May, 1956, 45 hearing handicapped children enrolled in as many classes were found who met the above criteria. A total of 1,258 children (669 boys and 589 girls) were included in the study. Among these 45 subject the following subgroups were identified: boys (16); girls (29); those with a mild hearing loss of less than 50 db (27); those with a more severe hearing loss of more than 49 db (18); those wearing hearing aids (7); and those not wearing hearing aids (38).

The Wilcoxon matched-pairs signed-ranks test was used for the statistical analysis in which the subject's score was "paired" with the mean score of his classmates.

Results

Hypothesis 1: As a group, hearing handicapped children were not accepted as equal peers at the 5 percent level of confidence when total status scores were the criteria.

Hypothesis 2: As a group, the hearing handicapped were not as well accepted as their classmates when friendship scores were the criteria. Among the subgroups, only the scores for those with "mild losses" and those "not wearing hearing aids" were significant.

Hypothesis 3: As a group, the hearing handicapped did not receive as favorable reputation scores as those of the average in the class. Among the subgroups, only the scores for those with "more severe loss" and "those wearing hearing aids" were significant. On personality, neither the scores for the total group nor the scores for any of the subgroups were significant.

Hypothesis 4: No significant difference was found between the two groups in accuracy to perceive their friends and non-friends.

While the mean scores on social acceptance for the hearing handicapped as a group were below the mean scores for the normally hearing children, there was a wide range of acceptance of hearing handicapped children as individuals. This fact indicates that when school administrators are considering special class placement or other educational programs for hearing handicapped children they need to know the academic level and social adjustment of the individual in his present situation. The primary concern of school administrators, when planning special educational programs, is the academic achievement of the child with the improvement of social acceptance a subordinate goal. Microfilm $2.00; Xerox $6.00. 121 pages.

A STUDY OF INTERGROUP RELATIONS AS REVEALED BY CONTENT ANALYSIS OF LITERATURE TEXTBOOKS USED IN CATHOLIC SECONDARY SCHOOLS

(L. C. Card No. Mic 59-895)

Sister Mary Linus Gleason, C.S.J., Ph.D.
St. Louis University, 1958

This study is an investigation of the intergroup content of curriculum materials of four sets of literature textbooks that are currently most widely used in the teaching of literature in the secondary Catholic schools.

The investigation was made through two avenues of approach: an analysis of speaking characters in the selections and a study of the expressions which in the light of the situation reflected prejudicial thinking. The analysis of the speaking characters was made on the basis of the following groupings: racial, socio-economic, religious, community background, and ethnic origins.

The study revealed a differentiation of treatment of the characters in all areas under consideration.

(1) Racially all textbooks are oriented toward the Caucasoids and away from Negroid and Mongoloid races. Although characters worthy of emulation were found in all races, more were listed among the Caucasoids. Their number was greatest also among those who displayed qualities of leadership and higher educational ability.

(2) Socio-economically the middle class was the most favored group numerically but the upper-class members were more frequently cast in major roles and were better educated. Illiteracy and minor role parts were attributed more often to lower economic members. Character traits could not be predicted on the basis of socio-economic groupings and characters worthy of emulation could be found in all groups.

(3) Of the 41.1 per cent of the characters whose religious affiliation could be determined, the Catholics predominated with 21.7 per cent average in the three sets compiled for Catholic school use. In the set compiled for

general use the non-Catholic Christians had the largest representation with 21.3 per cent. The non-Christian and pagan groups were in the minority in all texts. The treatment of the groups regarding roles played, educational status, and positive character traits revealed slight variation and worthy members were found in all groups.

(4) Character analysis based on community background showed a comparatively even balance between the urban and rural both in numbers and leadership. The urban characters appeared consistently better educated while illiteracy was more prevalent among rural characters. Positive character traits predominated among the rural and negative traits were attributed more generally to urban people.

(5) Ethnicity of the characters was based upon 63.7 per cent of the characters and of these the majority were of Old Immigrant stock. These exceeded the New Immigrants by an average ratio of 5 to 1 in all sets. Indians and Negores constituted a small percentage of the people and were less favorably treated in most categories. Old Immigrants received a more favorable treatment in character trait analysis as well as numerically and educationally.

Prejudicial expressions were found in all four sets of texts. Unguarded statements which could provoke prejudicial thinking were cited. Generally the teaching materials overlooked these instances where teacher interpretation was needed.

The study revealed that a differential treatment was accorded to the various groups in the five areas considered and that there is a need for more adequate teacher guidance in the interpretation of material which is open to the charge of contributing to the growth of prejudice.

Microfilm $3.50; Xerox $11.80. 269 pages.

NATIONAL ORGANIZATIONS IN THE EDUCATION PROFESSION AT MID-TWENTIETH CENTURY: PRESENT STATUS AND FUTURE DEVELOPMENT

(L. C. Card No. Mic 59-1101)

John Martin Groebli, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Roosevelt Basler

Dual purposes existed for this study. The first was to determine the nature and extent of national organizations in the American education profession. The second was to develop a philosophy and a proposal for the future organizational complex of such groups.

From interviews, a check sheet instrument, and a search of the many and varied association publications came data revealing the nature of the organizations. An analysis of American society and the general field of education today was drawn from sociological, philosophical, historical, psychological and educational writings. A combination of all these resources was used in the development of a philosophy and proposal for the future.

Mid-twentieth Century America

The American culture has been and still is extensively marked by a grouping and re-grouping into a multitude of voluntary organizations. Americans are joiners and joint workers for causes, crusades and collections; principles; practices and projects; services, savings and satisfactions.

In recent years the study of such groups has expanded rapidly. Interest in group dynamics, human relationships, and social psychology is producing new research and developments applicable to the web of interrelationships in which Americans are enmeshed. This takes place at a time in history variously referred to as an age of anxiety, fear, caution, and/or crisis.

Education and its practitioners are in the swirling milieu. An excess of students and a shortage of facilities and teachers compound the confusion. Yet education, by far the largest endeavor in the nation, when measured by the number of persons actively participating in it, is looked to almost as a panacea.

The Organizations

In keeping with other expansion on the general social scene, education organizations on a regional and national basis have more than tripled in number in the last forty years. The total now approaches four hundred. Those on the state and local level approach ten thousand in number. There are associations of individuals, associations of institutions, and even a few associations of associations.

In the first portion of this study the regional and national associations were first categorized by type, special interest area, and educational level. Next, eighty of the national groups were analyzed in terms of certain membership, employee, and financial factors. Finally detailed descriptive data about the largest national organizations were presented. Numerous aspects were noted regarding origin and development, membership, structure, finances, activities, and relationships. Organizations for which detailed descriptive data were presented include the following:

American Association for Health, Physical Education and Recreation
American Association of University Professors
American Vocational Association
Association for Childhood Education, International
Association for Higher Education
Association for Supervision and Curriculum Development
Department of Elementary School Principals
Music Educators National Conference
National Association of Secondary-School Principals
National Council for the Social Studies
National Council of Teachers of English
National Education Association
National School Public Relations Association
National Science Teachers Association
United Business Education Association

Development of the Proposal

Basically the future development and function of national organizations in the profession will be determined by the rationale of unity and/or diversity. The historical development of the United States and its people, plus indices of the present era, indicate that a blend of unity and diversity, rather than an either-or choice, offers most promise. Significant facets of America at the mid-twentieth century plus projections for the age ahead denote an inclination toward greater unity.

The common end of every educational organization is

better education for all; it can be accomplished best if diversity is not chaotic and unity is not uniformity. A functional type of action can capitalize on both the similarities and differences of the groups.

The means proposed for this is the Council of Organizations in the Education Profession, or briefly, CO-EP. This new organization of organizations is designed to effect coordination and cooperation through service.

Constitutions, forms, diagrams, and procedures only describe man's social structure; it is man himself who sets and derives the values. The proposed organization named CO-EP can be only the vehicle, not the destination.

Microfilm $6.45; Xerox $22.40. 506 pages.

THE EFFECTIVENESS OF THE INDIVIDUAL PARENT-TEACHER CONFERENCE METHOD FOR REPORTING PUPIL PROGRESS IN ELEMENTARY SCHOOLS

(L. C. Card No. Mic 59-1057)

Bernard F. Haake, Ed.D.
New York University, 1958

The purpose of this investigation was to ascertain the effectiveness of the individual parent-teacher conference method for reporting pupil progress in elementary schools; to discover the important factors which contribute to an effective parent-teacher conference; and to evolve recommendations that might be used to improve the conference method. Because of eight years of experience with the conference method, the City School District of Schenectady, New York, was selected as the locale for the investigation.

Procedures utilized included the following:

1. Analyses of the community and the school system were derived from information gained through interviews with city and school officials and from reports, periodicals, and documents issued by city departments and the school system.

2. An overview of the conference reporting method, including its eight-year historical development, was obtained from information gained through interviews with school officials and from reports and minutes of various school departments and committees.

3. Questionnaires were constructed and sent to 1,994 parents and 221 teachers. Forty-two per cent of the parents and 95.5 per cent of the teachers returned the questionnaires. Data were recorded separately in tables for parents and teachers, but their responses to the same items were also compared.

4. The data were analyzed and evaluated to determine: (a) the overall procedural and substantive effectiveness of conferences, (b) conference procedures, content items, and setting aspects considered important by parents and teachers, (c) reasons for dissatisfaction with conferences, and (d) factors responsible for the successful early institution of the conference method in Schenectady.

The nature of the community and the particular approach utilized by the Schenectady school system in inaugurating conferences were found to be largely responsible for the successful early institution of the conference method. The study revealed that certain setting characteristics, procedures, and content items of conferences were considered of primary importance by parents and the remainder were considered of supplemental importance.

Nearly 97 per cent of the parents were satisfied with conferences, and a very close relationship was found to exist between the importance ascribed by parents to conference content items and the degree of effectiveness which parents said was achieved in covering those items during conferences. An equally high correlation was found between the importance assigned to conference procedures by parents and the effectiveness which parents said was achieved in following said procedures.

Teachers appeared to be more favorably inclined toward the conference method as they acquired more experience with it, and parents and teachers were in substantial agreement regarding the relative importance of conference content items.

From an analysis of the findings, the following conclusion was reached: Individual parent-teacher conferences which, observe the procedures considered important by parents, emphasize the content items considered most important by parents, and cover all content items to a degree of effectiveness commensurate with the importance ascribed to them by parents, are procedurally and substantively effective means for reporting pupil progress in grades one through six.

Recommendations for improvement of the conference method based on analyses of parent and teacher responses include:

1. Each individual parent-teacher conference should be supplemented by a written conference summary/supplement which parents can take home from conferences.

2. A continuous parent-education program should be offered to increase parent understanding of school curriculum, purposes of the reporting system, and ways parents can improve their participation in conferences.

3. A training program should be provided for new teachers relative to the setting and content requirements of conferences, techniques, and procedures which achieve effective conferences, and the importance of human relations in conferences. The effectiveness of conferences should be periodically reappraised followed by recurrent in-service training for all staff members to correct revealed inadequacies.

Microfilm $3.20; Xerox $11.00. 247 pages.

EFFECTS OF CHANGING THE TYPICAL SEQUENCE OF HIGH SCHOOL SCIENCE COURSES TO 9TH GRADE BIOLOGY AND 10TH GRADE PHYSICAL SCIENCE

(L. C. Card No. Mic 59-522)

Lloyd Hugo Heidgerd, Ed.D.
University of Illinois, 1958

Two high schools were offering biology in the 9th grade and a physical science course in the 10th grade instead of the traditional general science in the 9th grade and biology in the 10th grade. A number of scientists and science educators had asserted that the newer sequence had educational advantages over the older. The object of this investigation was to evaluate the success of the newer sequence in the two schools.

Two approaches were used. In one the standardizing samples of the science tests of the World Book Company's

Evaluation and Adjustment Series were reorganized to represent distributions of average school achievement which had been adjusted to one IQ level on the basis of the within-school regressions of achievement upon IQ. The average achievement of the two schools and subgroups within them were then compared in terms of rank with the schools in the altered standardizing samples. In the other method the regression of school achievement means upon school IQ means within the standardizing sample was used to predict the achievement means of the two schools, given their mean IQ's. The obtained achievement means were then compared to these predicted means in terms of standard errors of estimate.

By these methods biology and general science achievement at the end of the 9th year biology course, general science achievement at the end of the 10th year physical science course, and physics achievement were measured.

In addition general science achievement at the end of the 9th year biology course was compared with general science achievement at the end of the 9th year general science course using control schools and the t-test. In like manner, attitude toward the course was compared between the two schools offering 9th grade biology and the two control schools offering 9th grade general science using the Silance A Scale to Measure Attitude toward any School Subject.

The findings indicate that biology achievement at the 9th grade level in the particular schools studied was somewhat inferior to that in schools where biology was taught in the 10th grade. However, if the method of the regression of school achievement means vs. school IQ means is used and an adjustment made for mental age, the students do just about as well as would be predicted.

General science achievement after the 9th grade biology is low as compared to the national standard.

General science achievement after the 10th grade physical science course, which one would expect to be high, as these people had had in effect a two-year general science course instead of the single year's course for which the test was designed, was above average but not significantly so. When the scores were adjusted for mental age, the results were close to average.

Physics achievement was high in the non-traditional schools.

As the attitude scale brought conflicting results favoring the 9th grade biology in one instance and the 9th grade general science in the other, no conclusions could be reached.

The limitations of measuring results in only two schools and the possibility that the numerical differences in achievement may not be educationally significant suggest that further study and replication will have to take place before conclusive results can be reached.

Microfilm $2.00; Xerox $6.80. 142 pages.

A STUDY OF THE ATTITUDES OF COLLEGE WOMEN TOWARD SELECTED INTERGROUP PROBLEMS AND THEIR RELATION TO CERTAIN BACKGROUND FACTORS

(L. C. Card No. Mic 59-898)

Sister Mary Agnes Hennessey, R.S.M., Ph.D.
St. Louis University, 1958

The Problem

This study explores the attitudes held among students in Catholic colleges for women toward certain intergroup problems in American democratic society. The areas of research are: (1) interreligious problems, or those of Catholics in a religious pluralism, (2) interracial problems, or those of white Catholics in an interraical society, (3) socio-economic problems, or those arising from rapid structural and ideological changes in social and economic life.

Procedure

A comparative study was made of the attitudes of freshmen and senior students in their relation to selected background factors. The procedure entailed the construction of three attitude scales according to the Likert method of summated ratings. Selected questionnaire items were distributed to 1,500 students in twelve midwestern institutions. Scale values were determined after the collection of data by the normal deviate weighting method. The contingency coefficient of correlations and the Kuder-Richardson formula were applied to the resulting scales to test item consistency and scale reliability.

Student performance on the attitude scales was analyzed in terms of relationship to personal history factors. Analysis of variance and factorial design were used when testing statistical significance of the outcomes.

Conclusions

Interreligious problems.--Freshmen and senior students vary significantly in their attitudes toward interreligious problems with seniors holding more favorable attitudes. This difference is statistically significant at the 1 per cent level of confidence. The student's major field of interest was also found to be a significant factor with philosophy-psychology and elementary education majors showing least favorable attitudes and language-literature majors holding most favorable atttidues. This difference is also significant at the 1 per cent level of confidence. A significant interaction of this factor and class indicates that in seven of the twelve major fields of interest freshmen show less favorable attitudes than seniors. The factors of religion and secondary school attendance both emerge as significant factors with differences significant at the 5 per cent level of confidence.

Interracial problems.--A majority of students favor racial integration on social, economic, educational, and political levels. Class differences significant at the 1 per cent level of confidence, show that seniors hold more favorable attitudes toward interracial problems. Students whose parents hold professional and managerial positions and are in higher income brackets have less favorable attitudes. Both factors, occupation of father and income bracket, show differences as significant at the 1 per cent level of confidence. Differences in major fields of interest are again significant at the 1 per cent level of confidence.

The factors of home location and religion also show differences significant at the 5 per cent level of confidence.

Socio-economic problems.--Seniors show more favorable attitudes toward socio-economic problems. This difference is significant at the 5 per cent level of confidence. The background factors, home location, occupation of father, and occupation of mother, are all significant at the 1 per cent level of confidence. Differences significant at the 5 per cent level of confidence appear in the income bracket factor. Interaction between class and the factors of secondary school attendance and residency shows significant differences in these variables at the 5 per cent level of confidence.

Microfilm $3.05; Xerox $10.40. 234 pages.

AN INVESTIGATION OF SELECTED FACTORS RELATED TO DROP-OUT STUDENTS IN THE COLLEGE OF BUSINESS AND PUBLIC ADMINISTRATION, UNIVERSITY OF ARIZONA, WITH IMPLICATIONS FOR TERMINAL BUSINESS EDUCATION

(L. C. Card No. Mic 59-857)

Richard Alvin Kidwell, Ed.D.
University of Arizona, 1958

Supervisor: Robert J. Letson

Purpose

As an indication of whether or not a need may exist in Pima County for an expansion of post-secondary terminal education in business, the study investigated the incidence, aptitudes, and achievements of drop-out students in the College of Business and Public Administration at the University of Arizona, and evaluated the sequence of courses taken by drop-out students as a terminal program in preparation for immediate business employment.

Methods and Procedures

Freshman classes in the College of Business and Public Administration in 1951-52 and 1952-53 were selected and listed by the use of IBM equipment. Data were gathered from University records, and students were analyzed in terms of aptitudes, achievements, personal data, and family background. Reasons for leaving and an evaluation of work taken were obtained by a mail survey of dropouts. The lower division Business Administration curriculum was compared with representative terminal curricula.

Summary

Of the entering freshmen, 62.5 per cent dropped out before completing requirements for a degree. After two semesters, 57 per cent of the dropouts had left, and after four semesters, 83 per cent had left. Approximately 32 per cent of the dropouts received grades equal to or higher than the average required for graduation.

Compared with graduates, the drop-out group was composed of larger proportions of females and non-residents. Distribution of Pima County residents was proportionately equal between the two groups. Dropouts were less apt scholastically and earned less of their own expenses. However, students who ranked in the third decile in scholastic aptitude graduated in approximately equal proportion to those who ranked in the fourth through the ninth deciles.

The drop-out group who left the University earliest contained high proportions of females, non-residents, students over 21, dependent upon family for funds, undecided on a major, and from families in non-professional work categories, as compared with the entire drop-out group. The drop-out group who received highest grades contained high proportions of females, non-residents or residents of Pima County, students under 21, self-supporting, from the top five deciles in aptitude, from the top half of their high school classes, and from families in the non-professional work categories, as compared with the entire drop-out group.

Twenty-seven per cent of the dropouts left the University for disciplinary reasons or low grades. Thirty-one per cent transferred to another college or institution. Twenty-three per cent considered the work in the college unsatisfactory. Comments voiced dissatisfaction with the lack of early specialization, a need for additional counseling facilities, and a need for more personalized teaching techniques. The lower division program in Business Administration did not allow as great a proportion of vocational courses as did representative terminal programs; however, the majority of students followed the prescribed program.

Conclusions

Many students attended the College of Business and Public Administration who might have been served better by terminal curricula with standards equal to those at the University. Greatest apparent need was in secretarial, marketing, general business, advertising, and accounting.

Dropouts who were residents of Pima County received better grades and stayed longer than all other drop-out groups. Projected figures indicate that, in 1958, of the estimated 750 freshmen from Pima County, approximately 125 entered the College of Business and Public Administration and over 400 entered the University of Arizona predestined to dropping out before achieving degree status.

The expansion of terminal business education in Pima County would be desirable for Pima County young people, for Arizona industry, and for the preservation of professional standards in University curricula.

Microfilm $2.70; Xerox $9.40. 208 pages.

A COMPARISON OF THREE METHODS OF TEACHING SENTENCE STRUCTURE

(Publication No. 20,556)

Silvy Asher Kraus, Ph.D.
University of Minnesota, 1956

This experiment compares the effectiveness of three methods of teaching sentence structure to paired groups of juniors in Eugene High School, Eugene, Oregon. Two teachers were involved; each taught one section of Method I, Method II, and Method III.

The Henmon-Nelson Mental Ability Test; the Cooperative English Test, Lower Form Mechanics, Form X; the Cooperative English Test, Lower Form Effectiveness of

Expression, Form Y; the Kelley-Greene Reading Test; the Frogner Sentence Structure Tests, Units 1, 2, 3, and 4, Form A; and an original composition were used as pre-tests.

Students in Method I groups were taught five sentence structure units: completeness, subordination, coordination, clarity, and emphasis. Sentence construction in these units was presented according to the thought approach in relation to the expression of ideas. Grammatical explanations were given only when requested. Students spent part of each class period working in groups on items which had for them been particularly difficult.

Students in Method II were given the identical sentence structure units by the same method. In addition, these students wrote weekly themes which were corrected and returned, but whose errors in sentence structure were not considered.

The five sentence structure units were not used in Method III groups. In connection with the activities of a literature unit, these students wrote weekly themes which were corrected and returned, the errors in sentence structure becoming the basis for instruction.

The Cooperative English Test, Lower Form Mechanics, Form Y; the Cooperative English Test, Lower Form Effectiveness of Expression, Form X; the Frogner Sentence Structure Tests, Units 1, 2, 3, and 4, Form B; and an original composition served as post-tests.

Analysis of variance and covariance demonstrated significant gains for all methods, but little difference between methods. However, Method III effected its gains in one-third the time required for the other methods.

This study suggests the following implications for classroom teaching:

1. A method of teaching sentence structure by a thought method which also took into consideration the varying needs of students resulted in significant gains in the ability to choose the punctuation and usage items which correctly completed sentences.
2. These gains were significant for all methods alike. However, the gains were effected in classes taught by Method III in one-third of the time required for the other methods.
3. Significant gains were also shown in the ability of all students to choose the most effective expression of a thought on the Frogner Tests. The difference in gains effected by the three methods was also significant, Method II appearing to be the most effective.
4. No one method was more effective than another in causing students to present original thoughts in sentences which indicated increasing maturity.
5. The method of attending to sentence structure principles which have caused difficulty in original sentences appears to be as effective in promoting sentence structure growth as is a more complete presentation of sentence structure principles in a predetermined order. This method effected its results in one-third of the time required for the other methods.
6. It appears that the method of teaching sentence structure in connection with unit teaching is as effective in promoting growth as are long periods of drill in sentence structure principles.

Microfilm $3.90; Xerox $13.20. 304 pages. Mic 58-5237

A COMPARISON OF THE TEACHER, CHILD, PARENT, ADMINISTRATOR, AND PEER GROUP PERCEPTION OF NON-CONFORMING BEHAVIOR OF A GROUP OF CHILDREN IN AN ELEMENTARY SCHOOL

(L. C. Card No. Mic 59-216)

Dorothy L. Martin, Ph.D.
Northwestern University, 1958

Supervisor: Jack R. Childress

This study was designed to demonstrate and explore the differences in teacher, child, parent, administrator, and peer group perception of non-conforming behavior in one elementary school in Chicago. The investigation was conducted over a period of twenty weeks utilizing a sample of forty-two deviant and forty-two control cases. These individuals were selected by the teachers in the school.

The hypotheses were advanced (1) that there were differences among the various groups in the perception of both overt and covert behavior of the deviant child, and (2) that perception was affected by ego-involvement and by differences in frames of references.

Data were collected using three instruments: The Behavior Check List (designed by the author), The Children's Manifest Anxiety Scale, and Cunningham's Social Analysis of the Classroom Questionnaire. A Check List for each deviant child was filled out by the teacher and the administrator. Check Lists for these same children were filled out by the administrator for the parent and child from answers given by these two groups on a questionnaire containing similar items.

The Children's Manifest Anxiety Scale was used to compare teacher, child, and parent perception of anxiety (as measured by this instrument) of both deviant and control children.

The Questionnaire was used to determine the differences in group and self-perception of the deviant and control groups.

From a statistical analysis of the data, evidence seemed present to justify the following conclusions:

1. There were no significant differences in perception of the most gross evidences of non-conforming behavior as indicated in five categories of the Check List.
2. There were significant differences in perception in the remaining categories of this List.
3. There were no significant differences in the teacher, child, and parent perception of anxiety in the deviant child.
4. There were no significant differences in the child and parent perception of anxiety in the control child. There was, however, a significant difference here in the perception of anxiety by the teacher. The teacher rated anxiety much lower than did the other groups.
5. Anxiety (as measured by the CMAS) was higher in the deviant than in the control child.
6. The Classroom Questionnaire revealed significant differences in perception between the group and the deviant child, and between the group and the control child. Differences were greater when the deviant child was being observed.

7. The Questionnaire showed consistency in the self-analysis of the control child, and inconsistency in the self-analysis of the deviant child.

In summary, it was concluded that differences in perception of non-conforming behavior existed among the various groups. These differences were greater between the teacher and parent, and the teacher and child. Ego-relationships could explain the significant differences in the perception of the seriousness and the pervasiveness of the problem on the part of the teacher and parent. Further evidence of ego-relationship was found in the data related to the differences between the teacher and child perception of the child's reaction to the handling of the problem.

Differences in frames of reference might explain the differences between teacher and parent perception of early attempts to handle the problem, and the specific recommendations selected. Further corroboration for the frame of reference differences was seen in the fact that the administrator tended to agree with the teacher, and child tended to agree with the parent. Both the teacher and administrator agreed on the need for increased communication between the home and the school. The parent and child saw a solution to the problem through increased community facilities such as playgrounds and clubs. This choice was consistent with the parent and child's perception which minimized the seriousness and extensiveness of the child's non-conforming behavior.

Microfilm $2.00; Xerox $7.20. 151 pages.

EFFECTS OF ABILITY GROUPING ON JUNIOR HIGH SCHOOL ACHIEVEMENT

(L. C. Card No. Mic 59-1108)

William B. Martin, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Erick Lindman

This study was a retrospective analysis to determine and analyze the effects of ability grouping on achievement of junior high school pupils, as practiced under oridnary school conditions. Three junior high schools, of Nashville, Tennessee, were selected for this study. School A used ability grouping; School C used moderate ability grouping. The third school, School B, which had no ability grouping plan, served as the control school. Pupils selected for this study had attended the same school for grades 7, 8, and 9. They had not been retained in any of these grades. An estimate of the pupils' I.Q. and comparative achievement scores, based upon the results of the Stanford Achievement tests, were required in at least one subject. From the Stanford Achievement test results for total battery and all subtests, the investigator computed the gain from grades 6 to 7 and/or 7 to 8 and/or 6 to 8. The I.Q. scores, ranging from 66 to 140, of the 176 pupils from the three schools were divided into approximately three equal parts to make up the high, middle, and low I.Q. groups. A 3 x 3 factorial analysis of variance was used to test for differences in achievement gains between schools, differences in achievement gains between I.Q. groups, as well as a possible interaction between these two variables. The I.Q. groups were made proportional by random selection. Since this was an exploratory study, no experimental hypotheses were formulated. The null hypothesis was tested: Mean Gain in School A = Mean Gain in School B = Mean Gain in School C. The .05 level of significance was used for analysis of all tests.

Findings of the Study

It was found that nongrouping was as effective as the grouping practices of the two experimental schools, when effectiveness was measured by gains made on the Stanford Achievement test. The pupils of the nongrouped school performed equally as well as the pupils of the two grouped schools in the 6 to 8 grade gains in reading, science, social studies, spelling and study skills achievement. However, the pupils of the nongrouped school did significantly better than the pupils of the modified grouped school in the 7 to 8 grade gain in total battery achievement. This might be attributed to an accumulating factor operating in the subtests since there were no significant differences revealed in the subtests. In language achievement from grade 6 to 7, the pupils in the three I.Q. groups of the grouped school demonstrated a significantly greater gain than the pupils of the nongrouped school. This could be attributed to ability grouping.

There were no statistically significant differences among I.Q. groups in the three junior high schools. The I.Q. groups of the three schools revealed that each school helped the high I.Q. group in arithmetic achievement more than the middle or low I.Q. groups in the 6 to 8 grade gain. There was no statistically significant interaction found between I.Q. groups or schools for any grade gain or any subject area. No. I.Q. group was materially benefited by the use of ability grouping.

Microfilm $2.00; Xerox $6.20. 129 pages.

A MANUAL OF OPERATION FOR BOYS' CLUB RESIDENT CAMPS

(L. C. Card No. Mic 59-1060)

Mortimer H. Morris, Ed.D.
New York University, 1958

Chairman: Professor Kenneth Benson

The purpose of the study was the preparation of a manual of operation to serve as a guide for local Boys' Club administrators in the planning, establishment, and administration of Boys' Club resident camps.

Camping is not a new area of Boys' Club programming, for Boys' Clubs have been among the pioneering agencies in the field of camping. They were among the first to inaugurate woodcraft camps, caddy camps, farm camps, outpost and pioneering camps, day camps, and roof camps. However, despite such interest in camping, an operational manual for the planning, establishment, and administration of resident camps had never been developed.

The study was divided into two parts. Part one was concerned with the necessary research preparatory to the writing of the manual. Part two was devoted to the manual.

Part one of the study was divided into three tasks.

These dealt with Boys' Club practices, general practices and the establishment of principles for Boys' Club resident camps.

Task one was concerned with the study of existing practices among Boys' Club in regard to the planning, establishment, and administration of resident camps. Boys' Club camps were contacted through questionnaire and studied through their reports, manuals, and other printed materials. Boys' Clubs of America files, records, and publications were also carefully studied.

Task two dealt with the study of current practices and prevailing patterns in the camping movement in the United States, through careful culling of the modern camping field in regard to literature, existing standards, and prevalent procedures.

An initial source of information included national agencies and organizations sponsoring camping programs. There were two reasons for this choice: 1. Boys' Clubs fall into the organizational classification and undoubtedly face many of the same problems. 2. Since 79% of the country's camps fall into this category, it is the single largest source of information on practices and patterns in the modern camping movement.

Literature in the field was taken from lists of books and periodicals recommended by acknowledged leaders in the field of camping. From this literature coupled with agency publications and information a composite picture was made of current practices and prevailing patterns in the resident camping field in the United States.

Task three involved the establishment of principles which might serve as a guide in the preparation of the manual of operation for Boys' Club resident camps. It was felt that through a groundwork of sound principles, effective standards and techniques could be more easily developed for use in planning, establishing, and administrating Boys' Club camps.

In addition to sound camping practices it was considered essential to insure that all principles relating to Boys' Club resident camps conform with the principles governing Boys' Club operation. Therefore, this task delved into basic philosophies and interpretation of the Boys' Club movement.

Part two of the study was devoted to the preparation of the manual. The development of the manual employed the principles established in task three. These principles served as the foundation upon which the manual was constructed.

The practices studied in tasks one and two also served in a valuable capacity. Where weaknesses were evident, effort was made to strengthen procedures. However, throughout the writing strict adherence was kept to established principles.

The principles and the manual were both presented to the National Program Committee on Camping of Boys' Clubs of America for final approval.

Microfilm $2.85; Xerox $9.80. 217 pages.

A SECONDARY SCHOOL CURRICULAR INVESTIGATION ON CHILD GROWTH AND DEVELOPMENT

(Publication No. 24,366)

Charlene Darr Palmer, Ed.D.
University of Missouri, 1957

Supervisor: R. K. Watkins

PURPOSE: This study was conducted in an attempt to determine some objective basis for developing a course in child growth and development for secondary school pupils.

METHOD OF RESEARCH: The major sources of data were (1) the questionnaire prepared and mailed by the writer to a jury of outstanding people in child development, (2) seven books on child development approved by the jury, and (3) articles pertaining to child development appearing in the 1953 issues of ten popular home periodicals.

SUMMARY:

(1) According to the analysis of the seven "approved" books in child growth and development, there are overall principles of child development and also principles concerned with the details of child growth and development. (These are listed in detail in the dissertation.)

(2) Two of the overall principles of child growth and development refer to what is commonly known as "ages and stages."

(3) Some of the magazines used in this study contain a much greater number of articles than the others in the field of child growth and development.

(4) Parents' Magazine contained the largest number of articles on child growth and development. Better Homes and Gardens and Good Housekeeping were fairly good sources.

(5) The books and the magazines include practically the same topics.

(6) According to the emphasis in the magazines behavior problems are of great concern to parents.

(7) There is a fairly common agreement among the magazine articles and the books on content.

RECOMMENDATIONS: Based upon the research reported in this dissertation the writer suggests that the following be included in a course in child growth and development for secondary school pupils:

(1) The overall principles of child growth and development plus the principles that pertain to certain details of child development.

(2) The nine "ages and stages" of growth upon which there is agreement among the seven "approved" books.

(3) The topics that received the greatest amount of emphasis in the books and/or the magazines.

Microfilm $3.00; Xerox $10.40. 232 pages. Mic 59-1926

SCHOOL CAMPING IN FLORIDA: A GUIDE FOR LOCAL SCHOOL ADMINISTRATORS IN THE PLANNING, ESTABLISHMENT AND ADMINISTRATION OF SCHOOL CAMPING PROGRAMS

(L. C. Card No. Mic 59-1048)

Frank Excell Philpott, Ed.D.
New York University, 1958

Chairman: Professor Milton A. Gabrielsen

School Camping is a vital, emerging movement in education. It has met with rapid growth and favorable acceptance. The school camp, destined to be as much a part of the school facilities as the library, cafeteria, and gymnasium, has provided learning opportunities in "classrooms under the sky."

School camping is based upon the principle that those things which can be taught best inside the schoolrooms should be taught there, and that those things which can be learned best outside the school should there be learned. Over five hundred school systems in more than half the states now conduct programs in school camping, and the number of such programs is increasing at a rapid rate.

The fact that many of the lessons taught in the classroom indoors may be better taught in an outdoor camping situation offers a distinct challenge to educators. The implication appears quite plain that the question of school camping and its relationship to the total education of youth should be considered in all of its aspects.

In general, this study was devoted to the development of a guide for school camping in Florida. Letters from the State Superintendent of Public Instruction, the Director of the Division of Instructional Field Services, and the Consultant for Health, Physical Education, and Recreation recognized the need for such a study, and offered the assistance of the State Department of Education toward its successful conclusion.

The purposes of the study were: (1) to determine the basic objectives of school camping and their potential contributions to the accomplishment of the educational objectives of the Florida State Department of Education; (2) to ascertain and examine the factors which may influence the development of school camping in Florida; (3) to establish guiding principles for the development of school camping; and (4) to develop a State Department of Education Guide, "School Camping in Florida," to assist public school administrators in the establishing and operation of school camping programs. Each purpose formed a subproblem for the study.

Objectives, factors, and principles were developed by the search into the literature and by personal interviews. This was followed by the use of two juries in each subproblem, one composed of authorities on school camping and the other of educational leaders in the state of Florida. These juries were asked to judge statements for completeness and accuracy as well as for duplications and omissions.

Through this process, the following results were obtained: (1) Eleven objectives of school camping; (2) Eight educational objectives of the Florida State Department of Education; (3) Fourteen general factors which have influenced the development of school camping; (4) Sixteen specific administrative factors influencing the development of school camping programs; (5) Twelve factors which influenced the development of the Alachua County School Camp, Florida's only resident school camp; (6) One hundred and twenty-three guiding principles for school camping.

The product of the fourth sub-problem, A Guide for School Camping in Florida, was the outgrowth of all accumulated data. From the findings in the three sub-problems of objectives, factors, and principles evolved the logical chapters for the Guide. Part Two is entirely devoted to this final sub-problem, a guide for the planning, establishment, and administration of school camping programs in the public schools of Florida.

The chapters in the "Guide for School Camping in Florida" which developed from the findings of the study were as follows:

I. School Camping in Education
II. The Development of School Camping in America
III. Camp Crystal Lake, Florida's First Resident School Camp
IV. Public Relations
V. The School Camping Program
VI. The School Camp Staff
VII. Sites and Facilities
VIII. Administrative Organization
IX. Health and Safety
X. Legal Aspects
XI. The Development of Leadership for School Camping

The purpose of the Guide was to provide a document which would aid in the conduct of workshops and clinics on school camping, and which, when reproduced in bulletin or manual form by the State Department of Education, would assist school administrators in the organization and administration of school camping programs. With this end in view, close contact with the Florida State Department of Education was maintained throughout the study.

School camping as an important part of the Florida educational system has found its beginnings in one year-round resident school camp and in a number of school-sponsored day camps. Through a unified effort of all agencies, departments, and individuals concerned with school camping, it is expected that its advantages will be extended from Pensacola to Key West and reach into all the sixty-seven counties of the state. Ultimately it will be the children of Florida who will benefit.

Microfilm $3.15; Xerox $10.80. 243 pages.

A STUDY OF SELECTED VARIABLES RELATED TO PREFERENCE OF HIGH SCHOOL SENIORS FOR CERTAIN FIELDS OF STUDY

(L. C. Card No. Mic 59-986)

James David Powell, Ed.D.
University of Alabama, 1958

This study was concerned with trying to determine the attitudes, or preferences, of high school seniors for the ten different fields of study, art, English, foreign language, history, mathematics, music, physical education, science, social studies, and vocational education, and the relation of their preferences to the variables, sex, educational objective (whether they intended going to college or not), education of their parents, their socio-economic status, and their intelligence.

This entailed obtaining information concerning these variables and relating these variables to the expressed preference for the fields of study. The ultimate objective was to see if there were any statistically significant relationships between these variables and fields of study preference.

The Otis Quick-Scoring Mental Abilities Test: Gamma Test: Form AM was used to determine intelligence, Verner M. Sims' Fields-of-Study Motivation Record, Experimental Form, was used to determine preference, and a questionnaire was devised to determine educational objective, education of the parents, and socio-economic status. These instruments were administered to 775 seniors in nine Alabama high schools, and the data from them were coded and punched on IBM cards. The cards were sorted into the various sub-groups mechanically and the results tabulated.

The differences between the means of the sub-groups were calculated and tested for statistical significance by use of chi square. The degree to which the significant differences were related to the variables was determined by use of phi coefficient of correlation.

The results of the study revealed small, but significant, degrees of relationship between:

(a) sex and preference for art, English, foreign language, history, mathematics, music, physical education, science, and vocational education;

(b) educational objective and preference for art, English, foreign language, history, mathematics, physical education, science, social studies, and vocational education;

(c) education of parents and preference for art, English, foreign language, history, physical education, science, social studies, and vocational education;

(d) socio-economic status and preference for art, English, foreign language, history, physical education, science, social studies, and vocational education; and

(e) intelligence and preference for art, English, foreign language, history, mathematics, physical education, science, social studies, and vocational education.

Microfilm $2.35; Xerox $8.20. 178 pages.

AN ANALYSIS OF TEACHER AND STUDENT OPINIONS OF AN EXPERIMENTAL METHOD OF TEACHING HIGH SCHOOL PHYSICS THROUGH THE USE OF FILMS AS COMPARED TO TRADITIONAL METHODS

(L. C. Card No. Mic 59-1411)

Donald Thomas Scott, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Walter A. Wittich

This investigation has been confined to the collection and analyses of data concerning: (1) the opinions of a random sample of 30 teachers and their students toward the use of the "Harvey White" physics T-films in 30 experimental schools, (2) the opinions of the students studying physics by traditional methods in 30 control schools and (3) the interests in science as expressed by the students from the experimental and control groups.

This study is a corollary to the Wisconsin Physics Film Evaluation Project, which was designed to determine the effectiveness of using 81 of the 162 thirty-minute 16mm "Harvey White" T-films in the teaching of high school physics for one semester.

The data were collected from the teachers and students by means of a series of free-response and "check-type" questionnaires and interest inventories given periodically during the experiment. The data were tabulated and treated statistically by testing for significant differences through the use of analysis of variance factorial design. Correlations showing relationships between variables were calculated when appropriate. Percentages permitting comparisons of different-sized groups were determined when necessary. Data representing expressed opinions that could not be reported numerically were presented as direct quotations from the teachers and students.

Ten problems were proposed and considered in the tabulation and analysis of the data. A summary of the findings and conclusions taken from these analyses follows.

1. The teachers and students felt that the T-films offered excellent laboratory demonstrations, of which some could be used to replace traditional laboratory work.

2. Insufficient time was one of the major problems frequently mentioned by the teachers and students. They felt that T-films should be shortened or some of the films eliminated.

3. The teachers felt that the T-films had the greatest contribution to make in schools where the teacher is not prepared to teach physics and/or the laboratory facilities are limited.

4. The majority of the students did not like studying physics from the T-films as well as they did by traditional methods.

5. The majority of the teachers and students felt that the T-films presented too much new material at too rapid a pace.

6. The T-films did not provide for enough variety and flexibility in the high school physics course.

7. The T-films did not seem to help students develop or maintain interest in science when compared to traditional methods for teaching high school physics.

8. The students' study habits changed significantly when the T-films were used. The students reported that they did less textbook and out-of-class studying and writing-up of assignments but more note-taking and "paying attention" in class.

9. The teachers reported that they learned many helpful teaching procedures from the T-films.

10. Many teachers disapproved of giving up most of their class time to "another teacher": the T-film teacher. This feeling strengthened as the semester progressed.

11. The teachers and students felt that the T-films kept them on the topic of physics at a continuous pace.

12. The teachers expressed many opinions of the T-films, varying from strong "pro" to strong "con." About two-thirds of them expressed generally negative opinions toward using the T-films as compared to one-third who expressed generally positive opinions. In most cases the opinions expressed by the teachers were shared by the students.

It is believed that the results of this study can be used by (1) film producers as a guide in planning future film series, (2) teacher training staffs in instructing teachers to make more effective use of such film series as the "Harvey White" series, and (3) school administrators and classroom teachers in planning for future use of such film series. Microfilm $3.35; Xerox $11.40. 259 pages.

THE APPLICABILITY OF MULTIVARIATE DISCRIMINANT ANALYSIS TO THE INTERPRETATION OF CLASSIFICATION TEST SCORES AT THE UNIVERSITY OF KANSAS

(L. C. Card No. Mic 58-5644)

Frederick W. Simpson, Ed.D.
University of Kansas, 1957

Problem

The problem was defined by assuming that equations as developed by C. R. Rao could be used to classify entering freshmen according to curriculum majors on the basis of multiple test scores if such equations would lead to:

1. Significant group differences, and
2. Normal distributions of differences between classification scores of individuals on the equation of their own group and on equations of other groups.

Procedure

In the graduating population for three successive years (1954-1956), distributions of freshman scores on the K. U. Mathematics Test and on subtests of the A. C. E. Psychological Examination and the Cooperative English Test were found to be generally non-normal.

Separate equations for men and for women were developed for each curriculum in which there were tenty or more graduates of either sex. Six tests were used. Four-variate equations for women were also developed, omitting the A. C. E. quantitative score and a reading comprehension score, neither of which showed a significant among-to-within variance ratio in the women's groups.

D^2 was computed for seventy-eight pairs of groups and found significant in fifty-five of these.

Twelve classifications, involving from two to thirteen groups, were attempted. The proportions correct were compared with chance expectancy. Eight of these classifications were repeated with scores corrected to minimize risk of error when the a priori probabilities are unequal. The proportions correct were compared with the ratio of the size of the largest group in a classification to the total. Five were repeated with scores adjusted to allocate in proportion to a priori probabilities. The proportions correct were compared with the sum of the squares of the proportions in the various groups. Significance tests for correlated proportions were applied in all cases. Significance of departure from proportional allocation was also tested.

Assuming normality of distribution of the discriminant score differences, theoretical expectancies of proportion of correct classification were computed from the magnitude of D^2. Expectancies for numbers allocated to various groups under different conditions were also computed. The significance of departure of observations from these expectancies was determined for various pairs of groups.

Results

1. Classification was significantly better than the criteria applied in twenty-one of twenty-five cases. The other four involved groups in which D^2 was quite small.
2. Unless adjusted to allocate in proportion to a priori probability, the classification scores lead to allocations significantly different from these probabilities unless they are nearly equal.
3. No set of observations was found to differ significantly from predictions based on the assumption of normality of distribution of differences.
4. The four-variate equations for women classified as well as those based on six variates.

Conclusions

Making allowance for expected regression of means in replications of the experiment, there is sound evidence of stable differences between groups. The group differences, however, are not sufficiently large to prevent the distortion of allocation among groups unless an adjustment is made to prevent this. Correction for minimum risk of classification error leads to overemphasis of the larger groups, while the basic equations would tend to equalize all groups. A counselor utilizing these equations would need to be aware of the decision rule implicit in the equations or any modification of them.

In this case, the preliminary analysis of variance for the purpose of locating the less efficient tests proved a worth while step. It would not substitute for tests to determine the optimum number of efficient measures to include in a matrix.

Microfilm $2.35; Xerox $8.20. 180 pages.

A FOLLOW-UP STUDY OF THE ACHIEVEMENT OF NEW YORK CITY TECHNICAL AND ACADEMIC HIGH SCHOOL GRADUATES IN ENGINEERING INSTITUTIONS OF HIGHER LEARNING AND IN TECHNICAL AND ENGINEERING JOBS

(L. C. Card No. Mic 59-1022)

Herman Slotkin, Ph.D.
New York University, 1958

Chairman: Associate Professor Milton Schwebel

In this study two groups of engineers and engineering students, one the graduates of the academic high school course, the other the graduates of the technical high school course, were compared as to their achievement in college and on the job. The purpose was to test the hypothesis that the technical graduates would evidence superior achievement to the academic graduates in engineering studies and employment. Students of the high school graduating classes of 1947, 1949, and 1954 were the subjects of this study. The technical and academic graduates were matched as to high school average, I.Q., reading grade, arithmetic grade, Regents grades in English, mathematics, and the sciences, hours devoted to study, number of high school extra-curricular activities, early positive interest in engineering, percent with foreign-born parents, father's occupational level, parents' educational level, siblings, social activities, health and scores on the Strong Vocational Interest Blank. The matching data revealed no significant differences between the academic and technical graduates for each of the years studied.

The achievement data revealed that for all years combined the technical graduates were superior in every criterion measure. The differences in college grade point average and percent working at supervisory levels were

significant at the four percent and one percent level respectively. All other differences for all years combined fell below the ten percent level.

Of twenty-one differences between the groups for the individual years 1947, 1949, and 1954, eighteen favored the technical group and three the academic group. For the year 1947, three of these differences were significant at the five percent level or better - grade point average, percent working at a supervisory job level, and job satisfaction score. There were no significant differences for the 1949 group. For the 1954 group a difference at the five percent level in the percent awarded scholastic honors favored the academic group. There were no other significant differences in this group.

It is clear that there were significant differences between the academic and technical course graduates in 1947. These differences favored the technical. However, these differences diminished in the 1949 class and all but disappeared for the 1954 group.

It is recommended that further research seek to discover the factors which accounted for the differences in 1947, and which have tended to disappear since that time, and to determine whether the lack of differences represents an improvement or decline in over-all quality.

Microfilm $2.00; Xerox $4.00. 72 pages.

THE EDUCATIONAL POLICIES COMMISSION, A LEADERSHIP ORGAN IN AMERICAN EDUCATION

(L. C. Card No. Mic 59-1118)

Walter D. Stille, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Dr. Erick L. Lindman

Three purposes are accomplished by this study. First, a history of the Educational Policies Commission, more comprehensive than any yet published, is set forth. The history tells what the Commission is, how it came into being, the purposes it holds, how it operates, how it is formed, what sanctions it has, and what it has done.

Second, the study synthesizes thirty-three major works published by the Commission and expresses them as positions and recommendations of the Commission. The pronouncements are organized in such a way that they bear on six topics, each of which has a timeless quality of importance for American education. These topics are chapter titles in the study:

Democracy and Education
Teaching for Citizenship
Government and Education
Safeguards of Democracy
Working with the Community
International Relations and Education

Third, an appraisal of the effectiveness of the Commission is presented through citation of three types of evidence. These facts about the circulation of publications are presented: who reads them; how many copies of various works have been circulated; and what use has been made of the publications. A second type of evidence points out instances in which educational practice reflects acceptance of Commission recommendations. In conclusion, opinions from some former members of the Commission are cited concerning its contribution to American education.

The pronouncements of the Educational Policies Commission have dealt with a wide variety of topics. Recommendations touch upon classroom procedure, curriculum, government, defense, international cooperation, and many other matters important to education. The Commission has never selected a theme, yet all its works point toward a single goal: maximum attainment of the fruits of freedom for all mankind through education.

Microfilm $3.15; Xerox $10.80. 241 pages.

GUIDANCE SERVICES IN THE STATE DEPARTMENTS OF EDUCATION IN THE UNITED STATES, WITH A PROPOSED PLAN FOR A GUIDANCE DIVISION IN THE ALABAMA STATE DEPARTMENT OF EDUCATION

(L. C. Card No. Mic 59-990)

Leon D. Willman, Ed.D.
University of Alabama, 1958

Chairman: Ralph M. Roberts

This dissertation is a study of the recommendations and opinions of outstanding writers in the field of guidance, a study of the present status of guidance services in the state departments of education in the United States and a study of the present status of guidance in the State of Alabama. It is the purpose of this investigation to provide suggestions as to how an office of guidance can be initiated and organized at the state level in the State Department of Education in Alabama.

The introductory chapter discusses the problem, the organization of the study, the history and present status of the problem, the sources of data, the procedure, the treatment of the findings, and the limitations of the study.

The second chapter is a review of the literature. It becomes functional in supporting suggestions made in the last chapter.

The third chapter contains the findings from a national questionnaire answered by all forty-eight states. It ascertains the present status of guidance at the state level in America.

The fourth chapter presents the findings from a statewide questionnaire sent to all superintendents of schools in Alabama with a seventy per cent return. It ascertains the present status of guidance in Alabama. Guidance services at the state level in Alabama were found to be, for all practical purposes, non-existent. There is no person either full-time or part-time in the State Department of Education in Alabama whose major responsibility is serving recognized needs of schools and school systems in promoting guidance services in the state. Alabama was found to be the only state in the United States which did not have a person designated as director of guidance or of pupil personnel services, according to the Guidance and Student-Personnel Section of the U. S. Office of Education.

The present status of guidance services at the local level in Alabama was found to place Alabama near the lower end of the list of the forty-eight states, so far as guidance services to its public school students is concerned.

The fifth and last chapter presents forty-one proposals

to improve guidance services at the state level in Alabama, based on (1) comments of writers in the field of guidance (2) most common practices in other state departments of education in the United States. Each proposal is supported by the opinions of authorities in the field of guidance and/or by common practices in other state departments.

The forty-one substantiated proposals cover the following seven large areas of guidance at the state level. Organization, Administration, Services, Research, Counselor Preparation, Finances, and Certification.

Microfilm $3.15; Xerox $10.80. 243 pages.

QUANTITATIVE CONTENT IN ELEMENTARY SCHOOL SOCIAL STUDIES TEXTBOOKS

(L. C. Card No. Mic 59-1122)

Gilbert M. Wilson, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Harold Drummond

The major purpose of this study was to determine the nature and frequency of definite quantitative terms which appear in elementary school social studies textbooks and to determine whether or not these terms appear in arithmetic textbooks at corresponding grade levels. A further purpose of the study was to evaluate such devices as time lines, tables, and graphs as to accuracy of presentation in the social studies textbooks.

One history, one geography, and two arithmetic texts for each of the Grades IV through VII were analyzed for the purposes of this investigation. These books were chosen on the basis of frequency of mention on the adoption lists of those states comprising the Southern Association of Colleges and Secondary Schools. The definite quantitative terms found in the social studies textbooks were tabulated in twenty separate categories, resulting ultimately in the construction of forty-three tables which are contained in the study.

Findings of the Study

Cumulative totals indicate that 73,262 uses of definite quantitative terms are found in the social studies books. Slightly more than 58 per cent of this total is contained in the geography books. Considering the totals for each grade, the seventh-grade books contain a greater incidence of the terms than those of any other grade, but the quantitative content is heavier in the fifth than the sixth-grade texts.

When separate categories are considered, it is found that Arabic numerals, numbers expressed in words, time references, time measures, dates, and words with arithmetic connotation appear more frequently than do terms in other categories. Terms involving liquid measures, temperature, and decimals appear infrequently when compared with other categories.

When the terms found in the social studies books were checked for their appearance in the arithmetic books, it was found that, with certain exceptions, they appear generally at corresponding grade levels. The most notable exceptions occur in such categories as arithmetic symbols, statistical terms, and words bearing arithmetic connotation.

Devices such as time lines, tables, and graphs were checked in the social studies books for accuracy of presentation. These are not utilized to great extent by the authors. Except for time lines, all uses of such devices appear in the social studies books after their introduction in the arithmetic books. Time lines are not discussed in the arithmetic books at all. Errors were found in the construction of each of the three devices, the most serious being in the construction of pictographs.

Conclusions

The most significant feature of the analysis points out the wealth of quantitative terms employed by writers of elementary school social studies textbooks. Many different types of terms are used and they are used with great frequency by such writers. This indicates a need for concern by authors with regard to the choice of terms and accuracy in the presentation of their data. Teachers should be aware of the problems which social studies material presents to children, and they should direct their efforts toward helping pupils correctly interpret textual material which employs such terms and devices.

Microfilm $2.00; Xerox $5.20. 104 pages.

A STUDY OF PERSONALITY VARIABLES, AS MEASURED BY CERTAIN INSTRUMENTS, THAT MAY DIFFERENTIATE SCHOOL GUIDANCE COUNSELORS FROM CLASSROOM TEACHERS

(L. C. Card No. Mic 58-3935)

Beatrice Natalie Wolfson, Ph.D.
The University of Connecticut, 1958

Statement of the problem: It was the purpose of this investigation to study what personality factors might differentiate those individual who became teachers and who remained classroom teachers from those individuals who became teachers and who subsequently became counselors and guidance specialists.

The study seemed justified by the need to determine whether or not practising counselors possessed those personality trait constellations of a democratic philosophy, empathic ability, and a non-authoritarian personality which many authorities consider essential for counseling success; and whether or not such personality traits do differentiate counselors from classroom teachers. It was felt that the findings of this study might eventually be of help in the selection of counselor trainees.

Procedure: To test the hypothesis that there are personality traits as measured by certain instruments that distinguish those individuals who were classroom teachers and who remained classroom teachers from those individuals who were classroom teachers and who became counselors, the following steps were taken:

1. A sample of 98 counselors and 71 teachers, all employed at the secondary level in Connecticut school systems, was obtained as subjects for the study.

2. Four instruments, Teacher Opinionaire on Democracy by Ledbetter, The Empathy Test by Kerr and Speroff, a Q-sort on Empathy devised by the investigator, and The F Scale of Authoritarianism by Adorno et al, were used to

measure the personality trait constellations under consideration.

3. All subjects were presented the four instruments, using the mails for communication.

4. The data from these instruments were analyzed statistically to compare the two groups of subjects.

5. In addition, the data derived from each of the four instruments on a smaller sample of 20 pairs of subjects, matched in the four variables of sex, age, experience, and education, were treated separately and "t" tests were applied to determine if there were significant differences between these smaller but matched samples.

Results: Comparisons of the performance of the two larger experimental groups on the four instruments indicate:

1. On the Teacher Opinionaire on Democracy, there is a difference of 7.08 between the means of the counselors and teachers, with the scores favoring the counselors.

2. On the Q-sort on Empathy, there is a difference of 12.49 between the means of the counselors and teachers, with the scores favoring the counselors.

3. On The F Scale of Authoritarianism, there is a difference of 11.02 between the means of the counselors and teachers, with the scores favoring the counselors.

4. On The Empathy Test by Kerr and Speroff, there is a difference of 1.81 between the means of the counselors and teachers, but this difference is considered quite small.

Comparisons of the performance of the two smaller but matched samples on the four instruments indicate:

1. On the Teacher Opinionaire on Democracy, there is a difference of 3.55 between the means of the counselors and teachers, which is significant at the 5 per cent level of confidence. In this instance, the scores favor the teachers.

2. With the other three instruments used in the study, there are no significant differences between the means of the counselors and teachers.

Limitations of the study:

1. The larger samples of counselors and teachers were not representative nor random groups; therefore, inferential statistics could not be used and the conclusions are applicable only to the groups studied.

2. Only three personality trait constellations were investigated.

3. Dependency upon mailing seriously limited the kinds of devices that could be used in the study.

4. Teachers and counselors were not rated as to effectiveness in their professional roles.

5. The instruments used in the study could be criticized as being too crude for precise measurement of traits.

Conclusions:

1. The counselors and teachers of the larger sample differ in regard to the personality trait constellation known as a democratic philosophy, as measured by the Teacher Opinionaire on Democracy. The obtained scores tend to favor the counselors, indicating that the counselors may be more democratic in their attitudes and outlook.

2. The counselors and teachers of the larger sample differ in regard to the personality trait constellation known as empathic ability, as measured by the Q-sort on Empathy. The obtained scores tend to favor the counselors, indicating that the counselors may be more empathic in their dealings with others.

Empathy, as measured by the Q-sort on Empathy, is defined as the ability to put one's self without reservation into the frame of reference of another person and thus to understand his needs, feelings, and attitudes. When, however, empathy is defined as the ability to anticipate the reactions, feelings, and behaviors of others, the counselors and teachers show only a small difference in this aspect of empathy, as measured by The Empathy Test by Kerr and Speroff.

3. The counselors and teachers of the larger sample differ in regard to the personality trait constellation known as a non-authoritarian personality, as measured by The F Scale of Authoritarianism. The obtained scores tend to favor the counselors, indicating that the counselors may be more flexible and more permissive in interpersonal relationships.

4. With the small sample of matched subjects, the counselors and teachers show a significant difference, at the 5 per cent level of confidence, in the personality trait constellation known as a democratic philosophy, as measured by the Teacher Opinionaire on Democracy. In this instance, the obtained scores favor the teachers.

5. There are no significant differences in the performance of the matched sample of counselors and teachers on any of the other instruments used in the study.

6. The findings from the small matched sample of subjects are, in general, not in accord with the findings from the larger sample of counselors and teachers.

Microfilm $2.00; Xerox $6.60. 140 pages.

EDUCATION, ADMINISTRATION

RESIDENCE HALL HOUSING IN SELECTED COLLEGES AND UNIVERSITIES IN THE UNITED STATES

(L. C. Card No. Mic 59-786)

Ronald Emon Barnes, Ed.D.
University of Colorado, 1958

Supervisor: Professor Clifford Houston

To aid the student substantially in his adjustments to college life and his assumption of adult responsibilities, it becomes the duty of the college administrator and housing officer, continually to evaluate all aspects of the residence hall program in order to meet the needs of the resident more ably. The success of a program rests on this conjoining of objectives.

This study was planned and initiated to gain information about current thinking and practices of housing officers in four areas of residence hall housing, i.e., planning and construction, financing, counseling, and management; in order to identify and describe current as well as possible future trends and developments, and to develop and set forth principles which may serve to guide the appraisal of residence hall facilities and programs. Material for this study was assembled through an intensive review of the literature, personal interviews with many housing officers, and by use of a questionnaire which obtained responses from housing officers representing thirty-five colleges and universities in the United States.

The writer believed that an investigation of these sources would yield information about areas of concern in

residence hall housing which have previously received only fragmentary treatment or coverage. This study did not attempt to cover any one of these aspects exhaustively, but rather, to discover significant trends and developments which might be useful to those planning for future housing construction, and to present data and principles which might help housing officers to upgrade the operation of their residence halls.

The writer contacted thirty-eight housing officers who reputedly represent progressive, up-to-date residence hall programs. It was believed that these persons had a clear understanding of current developments and trends in this field as well as possible future trends. Thirty-five of the thirty-eight housing officers responded to the questionnaires, representing a return of 92.1 per cent.

For summarization purposes, the writer has presented selected summary statements and principles which may guide and influence housing officers and administrators as they plan and operate residence halls. Following are these statements which point up the results of this study:

1. Close cooperation between housing authorities and architects is essential during the planning stages, particularly in establishing a building "program," in developing statements of the institution's fundamental objectives in providing student housing and in determining the requirements of a specific housing project.

2. There appears to be an increasing awareness among college and university authorities of the educational influence of the students' living facilities upon the achievement of the institution's educational objectives.

3. The writer believes that residence halls will continue to be constructed of varying sizes, but they will be designed to provide for small group identifications.

4. The major problem facing the majority of housing officers surveyed in this study was that of financing the construction and operation of the residence halls.

5. Evidence indicates that an increasing number of colleges and universities are initiating counseling programs within their residence halls.

6. It is important that persons who manage residence halls chart their purposes by the expressed objectives of the institution and strive to find the means for their accomplishment.

7. The writer believes there is a trend toward centralizing the personnel and business operations of a residence hall system under one person, who in turn, reports to the business office and the dean of the student's office.

8. It may be concluded that the organizational structure of dormitories varies considerable throughout colleges and universities.

9. Finally, the future of residence hall housing should be marked by better coordination and cooperation between the business and personnel staffs.

Microfilm $3.60; Xerox $12.20. 278 pages.

UNDERGRADUATE WITHDRAWALS AT VANDERBILT UNIVERSITY

(L. C. Card No. Mic 59-1086)

William O. Batts, Jr., Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Arville Wheeler

The purpose of this study was to determine the time and extent of undergraduate withdrawals at Vanderbilt University, the differences in certain institutional groups in this respect, and the extent to which certain personal factors affect persistence. Institutional groups compared were: the three undergraduate colleges (Arts and Science, Engineering, and Nursing), men and women, day and boarding students, fraternity members and independent students, and public and private high school graduates. Personal factors studied were: total ACE scores, ranks in high school class, distances of college from home, ages at the time of entrance, and first quarter grade point averages. The study included 585 undergraduates who entered Vanderbilt in the fall of 1950 and who would normally have graduated in June of 1954. The criterion of success was graduation from a four-year accredited college with a bachelor's degree as opposed to withdrawal before graduation. Only objective data obtained from records at Vanderbilt and at the colleges to which transfers went were used.

Findings of the Study

Fifty-four and five-tenths per cent of the entering Arts and Science freshmen class, 58.6 per cent of the entering Engineering class, and 26.3 per cent of the entering Nursing class had graduated at their school of original entry by June of 1957. When the number of students who graduated late was deducted, the percentages of students who graduated in normal progression, i.e., on or before June of 1954, became 45.9 per cent for the Arts and Science class and 46 per cent for the Engineering class.

Fifty and seven-tenths per cent of the Arts and Science withdrawals and 68.8 per cent of the Engineering withdrawals left during or at the end of the freshman year. In the College of Arts and Science and School of Engineering the end of the freshman year was the time when the greatest number of withdrawals took place. Records indicated that most withdrawals were for reasons other than lack of ability.

While the Engineering School graduated a slightly higher proportion of its entering students than did the Arts and Science College, the chi square test did not show the difference to be significant. The withdrawal figure in the School of Nursing, however, was quite large in comparison. Men had a higher proportion of graduates than did women, local students surpassed boarding students, and the private high school graduates surpassed public high school graduates, but none of these differences was found to be statistically significant when the chi square test was applied. However, when the proportions of graduates among fraternity members and among independent students were compared in the Arts and Science College, the difference in favor of the fraternity members was found to be statistically significant. Fraternity members in the School of Engineering also graduated a higher proportion, but the difference was not statistically significant.

The ages of students at the time of entrance and the distances of the students' home from Vanderbilt were found to have little or no bearing on the graduation prospects of students in the Arts and Science and Engineering Colleges. Both total ACE scores and high school rank showed positive but small biserial coefficients of correlation with the dichotomous criterion, graduation-withdrawal. In the Engineering School the ACE score biserial r was .45, and the high school rank biserial r was .37. The multiple r was .50. In the Arts and Science College the ACE score biserial r was .17, and the high school rank biserial r was .21. The multiple r was .23.

Microfilm $2.80; Xerox $9.60. 215 pages.

A CRITICAL ANALYSIS OF THE CENTRALIZED PUBLIC EDUCATION SYSTEM IN THE PHILIPPINES WITH EMPHASIS ON SECONDARY EDUCATION

(L. C. Card No. Mic 58-5197)

Josefa Bautista, Ed.D.
Indiana University, 1958

Chairman: Arthur Hoppe

The Philippine education system has been highly centralized since its establishment by the American founder in 1901. This critical analysis was concerned with finding out the reason why the system has remained highly centralized when the original conditions have changed, and suggested possible solutions to problems of centralization because there has been a growing dissatisfaction with the present state of education in the Philippines.

The method used was that of analysis and synthesis. The evaluative criteria were derived from related studies and literature, mainly those in the United States and partly those in the Philippines. For convenience, the studies were organized and reported in order: (1) books, (2) periodicals and pamphlets, (3) doctoral dissertations in the United States, and (4) Philippine materials. Then, for purposes of analysis, they were summarized in the form of principles, which in turn were codified into such broad areas as (1) fundamental objectives of education; (2) curriculum and instruction; (3) organization, administration, and supervision; and (4) finance. The authors of the related studies reviewed were in substantial agreement on each of the above aspects of public education. For this reason the formulated principles were considered a consensus with the force of evaluative criteria and were used as such in the present study.

Some of the major findings were as follows:

1. The organization and administration is somewhat too elaborate and intricate for efficiency and too stiff for human relations.

2. Supervision is mainly a check on the teachers to see that the prescribed methods are used, the course of study is adhered to, the lesson plans are prepared, the workbooks are used faithfully, and the themes are checked according to specifications.

3. The system is manned by intelligent people with democratic learnings and declarations. They understand and accept modern theories, but it seems that they cannot as yet voluntarily put community before self. There should be in-service education for them as well as for teachers.

4. The objectives and guiding principles of education in the country do not include the development of critical and creative thinking. High centralization must be relaxed in favor of critical and creative thinking.

5. The project on community schools is being carried on commendably but only at the elementary level and in the remote barrios; it has not yet been started in the secondary level. No reason is seen why the project should not be carried to the secondary level. Community schools are important on both levels--the elementary and the secondary. On the elementary level they provide a good start, and on the secondary they continue and keep up the good work. Education is a lifelong process, but it does not go on automatically even with a good start.

6. The trend away from the purely academic toward general education is encouraging; but there is still no work experience provided for third-year and fourth-year college-preparatory students, and there is less academic in the vocational division. There is something against each of the arrangements. The college-preparatory student must know something more than the academic; the vocational-preparatory student, other things being equal, is more likely to succeed in his vocation if he has a liberal education than if he does not. Finance is a very serious problem. The national, provincial, and local governments cannot cope separately with their financial obligations in education. Financing public schools must therefore be a partnership enterprise among them. Likewise, in all other aspects of the Philippine education system, a combination of centralization and decentralization should be adopted.

Microfilm $3.50; Xerox $11.80. 270 pages.

AN EVALUATION OF THE UNGRADED PRIMARY AS AN ORGANIZATIONAL DEVICE FOR IMPROVING LEARNING IN SAINT LOUIS ARCHDIOCESAN SCHOOLS

(L. C. Card No. Mic 59-888)

Sister M. Bernarda Bockrath, C.PP.S., Ph.D.
St. Louis University, 1958

Many changes in elementary school organization have been proposed to care for the wide range of abilities that exist among our growing school population. Among these is the ungraded primary organizational plan which eliminates grade lines and classifies pupils by levels of reading achievement. The plan differs essentially from traditional graded classrooms in the rate of learning and length of time spent on the various levels. The evaluation of such an ungraded primary organizational plan adopted by the St. Louis Archdiocesan schools in 1953 is the subject of this study.

The scope of the problem as investigated was actually three-fold: (1) to determine if this organizational device has resulted in better reading, (2) to report the specific findings of a three-year study of a group of children as they progressed through the ungraded primary unit in one of the Archdiocesan schools; (3) to ascertain through a survey of primary teachers if the program has contributed to an improved teaching-learning situation.

In evaluating the program, a comparison was made of the fourth grade reading test scores of 1953 and 1956 secured from the Archdiocesan records. The comparison

revealed a median increase of five months for the fourth grade pupils in 1956 over the reading performance of fourth grade pupils in 1953. A higher percentage of children in 1956 are over-achieving and a lower percentage are under-achieving as compared to 1953.

A stratified sample of fifty Archdiocesan schools furnished additional confirmatory evidence of increased reading achievement in 1956. The mean 1956 reading score for the fifty schools shows a six months' increase over that of 1953. A highly significant t-score of 15.17 indicates that some definite factor or factors are responsible for this increase. I.Q. can be dismissed as a nonsignificant factor in the reading gain, since a mean I.Q. of 104 was the same for both years. A new entrance age of 6.0 by September 15th was introduced in 1952. Operating within the framework of the ungraded primary, this later entrance age seems to be a contributing factor to increased reading achievement--comparative data showed a mean two months' increase in entrance age for first year primary entrants in 1953.

The three-year study conducted at one of the Archdiocesan schools gives a practical example of how the ungraded primary functions. Flexibility provided inter and intra-room adjustment to faster or slower-learning groups as the performance of children warranted it. Through the modified acceleration provision, twelve children entered fifth grade at the end of the third year primary. A significant finding in this part of the study indicates that when slow-learning children are given additional time at each level to attain mastery, their test scores, which reflect their achievement, are comparable to those of the more rapid learners.

The questionnaire answers revealed that an overwhelming majority of primary teachers favor the program and consider it a contribution to more effective learning and to teacher-growth.

Microfilm $3.40; Xerox $11.60. 263 pages.

THE SELECTION OF ARCHITECTS FOR SCHOOL BUILDINGS IN INDIANA

(L. C. Card No. Mic 58-5200)

Lorin A. Burt, Ed.D.
Indiana University, 1958

Chairman: M. E. Stapley

The Problem. The purposes of this study were to determine (1) methods and desirable and undesirable criteria for the selection of school architects as recommended in the literature, and (2) methods and essential and relatively unimportant criteria actually used by Indiana employing officials for the selection of school architects.

Research Procedure. An analysis of literature and research regarding the selection of school architects was accomplished through a review of books, periodicals, pamphlets, state planning manuals, and available research. Determination of actual practice in Indiana was accomplished through use of a questionnaire, validated by a "jury of experts," and completed by officials in Indiana who had employed architects for school buildings.

Principal Findings. The principal findings resulting from a survey of the literature were:

1. Writers are divided on the matter of use of architectural competitions for selection. Those recommending competitions specify that they be conducted under the AIA code.
2. Direct selection after consideration of more than one architect is recommended.
3. The procedure most frequently recommended for selection is use of questionnaires for initial screening followed by interviews for final screening and selection.
4. Investigation of architects is recommended, with visits to school buildings designed as the method most frequently recommended.
5. The architect should be selected early in the planning process, and many writers recommend that he be consulted in site selection.
6. Criteria mentioned most frequently as being desirable for selection include "reputation for working harmoniously and cooperatively with clients," "reputation for designing for economy of space and materials," and "reputation for integrity."
7. Criteria mentioned most frequently as undesirable include "fee cutting," and "provision of free sketches of proposed buildings."

The principal findings resulting from a study of the selection of school architects in Indiana were:

1. All employing officials used private architects.
2. A majority of employing officials considered more than one architect.
3. The method of initial screening used most frequently was the interview.
4. Nearly half the employing officials selected an architect after only one screening process.
5. Of the employing officials considering architects for final screening, a large majority used the interview method.
6. A majority of employing officials investigated architects, with the most common method of investigation being visits to school buildings designed.
7. Less than one fifth of the employing officials had architects under contract for over one year in advance of advertising for bids for construction, and a small number consulted architects in site selection.
8. Criteria listed most frequently as essential for selection included "reputation for preparing detailed working drawings and specifications," and "reputation for providing adequate supervision."
9. A relatively large number of employing officials listed "submission of free plans or sketches of proposed building" as essential for selection. This criterion is considered undesirable by many writers.
10. The criterion listed most frequently as relatively unimportant was "fee cutting."
11. Local architects were given preference and were selected in approximately one third of the cases.
12. School boards tended to use more desirable selection procedures and criteria than did township trustees.

Major Conclusions. The major conclusions resulting from the study were:

1. A need for careful architectural selection procedures exists in Indiana.
2. Employing officials should consider more than one architect, and should use more than one screening process in selection.

3. Certain desirable criteria should be used, and certain undesirable criteria should be avoided in selection.

4. Indiana employing officials should not use "submission of free plans or sketches of proposed building" as a criterion for selection.

Microfilm $3.35; Xerox $11.40. 260 pages.

A STUDY OF TOP EXECUTIVE SELECTION IN INDUSTRY WITH IMPLICATIONS FOR THE SELECTION OF COLLEGE PRESIDENTS

(L. C. Card No. Mic 59-1472)

Ramon Leonard Carroll, Ed.D.
The University of Tennessee, 1958

Major Professor: John W. Gilliland

Statement of the Problem

The purpose of this study was to investigate the problem area suggested by the following questions:

What have been the findings in industry concerning the selection of top executives? What implications may formal programs of selection in industry have for the selection of college presidents?

The primary concern of this investigation was to examine the literature and four programs of selection which are currently used in industry for selecting executives and attempt to identify and to appraise factors which appeared significant for the selection of college presidents.

Statement of the Sub-Problems

An analysis of the major problem area involved a scrutiny of the following adjuvant problems:

1. To survey literature in order to develop concepts of the industrial executive and the college president.
2. To examine and analyze four formal programs of selection in industry.
3. To identify and appraise significant patterns of executive selection which emerge from the findings of the four programs of selection in industry.
4. To identify implications which the programs of selection in industry have for the selection of the college president.

Scope of the Study

Limitations imposed upon the study were:

1. That the study should be made within the framework of findings in industry relating to executive selection between 1930 and 1959.
2. That the study be confined to analyzing and appraising data from four programs of selection in industry.

Procedures

The general research procedure of this study was survey, synthesis, analysis, and appraisal.

1. The literature was reviewed to show what conceptions of executives were expressed.
2. Four formal programs of selection in industry were analysed. Up-to-date materials were secured from the companies which sponsor the four programs of selection.
3. Interviews were held with industrial managers and specialists in personnel.
4. Patterns of selection were identified in terms of a simplified framework.
5. Identified selection patterns were appraised as to importance and feasibility by a jury.
6. The implications were analyzed in terms of usefulness for selecting college presidents.

Significance of the Study

The study may be of interest to those entrusted with the function of selecting top leaders. The findings of the study indicate an organized plan for selecting the college president which may serve as a guide when trustees are organizing or administering a formal program of selection.

Conclusions

1. The presence of formal selection programs in industry indicates that a problem in selection is recognized.
2. The four formal programs of selection are positive approaches to top leadership selection and indicate the application of intelligence.
3. Formal programs of top leadership selection have been conducted largely in industry.
4. The systematic procedures for surveying human resources indicate that attempts have been made to analyze many of the variables which determine effective selection.
5. A common thread runs throughout each selection program which indicates basic patterns of selection.
6. Formal selection programs are highly structured to meet specific needs.
7. Jury ratings on the basic patterns of selection indicate that the framework of basic patterns may be a sound basis for selection. To this extent, it appears that the proposition asserted in the underlying assumptions has been affirmatively demonstrated.

Recommendations

1. A study of trends in selection practices of boards of control using the pilot framework of patterns as criteria.
2. A study to adapt the suggested framework of selection patterns to specific situations.
3. Additional research in the area of defining the job of the college president.

Microfilm $2.85; Xerox $9.80. 219 pages.

ORIENTATION PROGRAMS FOR NEW TEACHERS IN SELECTED GEORGIA SCHOOL SYSTEMS

(L. C. Card No. Mic 59-1090)

Ruby Jo Champion Cooley, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Arville Wheeler

More and better teachers are needed in the schools today than ever before. This need is brought about by an

increased enrollment, the mobility of population, the demand for reduced teacher load, and the demand for better teaching.

Getting and keeping good teachers is a major problem of the schools. All teachers who are entering the profession, or who are facing a new assignment have the problem of adjustment and readjustment. The new teachers must become acquainted with new communities, new ways of doing things, new teaching personnel, and new pupils. The community that expects the beginning teachers to do good teaching from the start should do everything possible to help her with her adjustment problems. It is a matter of record that the adjustment process can be greatly facilitated by proper planning on the part of the school and the community.

When teachers become well adjusted in their work, they usually are happy teachers and perform efficiently in the classroom. Pupils in the classrooms today need such teachers. Orientation programs have been effective in obtaining, developing, and retraining good teachers.

This study was designed to identify and determine the relative helpfulness of orientation techniques and practices that are being used to help new teachers become adjusted to their teaching situations in twelve of the larger school systems in the state of Georgia. An effort was made to identify persons who were most helpful to the new teachers during the orientation period. One of the purposes of the study was to present, as outcomes of the study, recommendations for development and improvement of orientation programs.

Information useful in the conceptual framework of this study was gathered from the following sources: a review of related literature including research reports and comments and opinions of educational administrators; a study of literature describing the orientation programs of twenty-five of the largest school systems throughout the nation; and conversations held with graduate students on the campus of George Peabody College for Teachers. From this background of information a questionnaire was formulated.

The writer visited preschool orientation programs in three of the selected school systems. Teachers and superintendents were interviewed in each of the twelve systems. The questionnaires were distributed to five hundred teachers who had completed one year of teaching in their present positions. Four hundred fifty-eight, or 92 per cent, of the questionnaires were completed and returned.

After an analysis of the information the following salient points were identified:

1. Orientation programs are needed.
2. Teachers want orientation programs.
3. Superintendents are interested in obtaining information concerning the improvement of their programs.
4. The principal is the person identified as giving most assistance to new teachers.
5. Boards of education make no statement of policy or have a budgetary item covering teacher orientation.
6. Little evaluation of the teachers or the program takes place.
7. Teachers rate orientation services clearly valuable.
8. The purposes of the orientation program are not clearly defined.
9. Colleges take little part in orientation programs.

The following recommendations are made:

1. Administrators should give serious study to developing and improving their orientation programs.
2. The school, community, and college should cooperatively plan a program of recruitment and selection.
3. Much time, thought, and effort should be given assignment of teachers.
4. The orientation programs and teachers should be continually evaluated.
5. Boards of education should make a statement of policy and have a budgetary item covering teacher orientation.

Microfilm $5.05; Xerox $18.20. 396 pages.

THE ROLE OF THE ACADEMIC DEAN IN SELECTED CHURCH-RELATED COLLEGES

(L. C. Card No. Mic 59-1092)

Mack Wayne Craig, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Roosevelt Basler

This study is an effort to determine the role of the academic deans in a group of selected, church-related colleges, to compare their roles with an accepted theory of the deanship as set forth in the literature, and to formulate a proposal for the proper role of the dean of a church-related college. In the case of each college selected, a study was made of the relationship of the college to its sponsoring church, the historical development of the college and of the deanship in the college, the background of the incumbent dean, and the duties and functions of the dean in the college. This information was obtained from published sources, campus interviews, a questionnaire concerning duties and functions, and a daily log of activities kept by each dean for a period of one week. These findings were compiled, analyzed, and compared with an accepted theory of the deanship as set forth over a period of years in professional literature. On the basis of this study, and in consideration of the nature and purposes of church-related colleges, a proposal for the proper role of the dean in such institutions is set forth.

Findings of the Study

The role of the dean in the selected church-related colleges is determined more by the needs of the particular campus and the personality, interests, and background of the incumbent dean than by a consideration of the accepted theory of the office or a philosophy concerning the proper role of the deanship in the institution. Duties assigned to the office vary from college to college also in keeping with the number of other administrative officers and the nature of their responsibilities.

The deans of all ten colleges studied listed five duties which each performed in his institution. These were: engage in committee work, assign teacher load, approve applications for graduation, coordinate the work of the college, and preside at faculty meetings in the absence of the president. The last four of these duties do not appear among the eighteen duties most often assigned to the dean in the literature.

An examination of the list of actual duties most often performed by the incumbent deans and of the list of duties most often assigned to the office in the literature reveals

that a majority of instances in each case falls within the first eighteen items. Only seven duties appear on both lists. These are: organize and reorganize curriculum, supervise instruction, stimulate faculty growth, engage in committee work, approve student programs, recommend faculty promotions and salary increases, and serve as chief adviser to the president.

The deans of the selected colleges are more engaged in the mechanics of the educational process than is recommended in the literature. This preoccupation with routine matters does not leave sufficient time for efforts to inspire faculty growth, studies for the improvement of the curriculum, opportunities for students counseling, supervision of research, or formulation of educational policy. The deans have little part in the recommendation of additions to the faculty and the preparation of the academic budget.

The proposal of the proper role of the dean in church-related colleges calls for the deanship as a life of dedication to: serving the cause of Christian education, achieving dynamic personal leadership, meeting the needs of students, inspiring the faculty, defending the academic, welding unity, and dreaming dreams. Such a life of dedication will enable the dean to achieve honor for himself, to make a far-reaching contribution to the institution, and to enrich the lives of the students whom he serves.

Microfilm $3.60; Xerox $12.20. 278 pages.

THE STATUS OF THE ELEMENTARY SCHOOL PRINCIPALSHIP IN NEGRO SCHOOLS OF ALABAMA

(L. C. Card No. Mic 58-5608)

Dorothy Watts Draper, Ed.D.
University of Pittsburgh, 1958

The purpose of this investigation was to: (1) make a status study of the elementary school principalship in Negro schools of Alabama considering the professional preparation of the principals, the professional experience of the principals, the duties and activities in which principals engage, and the selection of elementary school principals; (2) compare certification requirements and standards for the elementary school principalship in Alabama with those in the other 47 states; and (3) evaluate the principalship through interviews with selected principals involved in the study.

The major part of the data was collected by questionnaires which were distributed to 320 principals who supervise elementary children in Alabama, and to 113 superintendents of education in the state. Interviews were held with 20 principals who comprised a selected sampling of the principals to whom questionnaires were distributed. Of the questionnaires distributed to principals, 87.5 per cent were returned. Of the questionnaires submitted to superintendents, 65.4 per cent were returned.

Five institutions in Alabama granted undergraduate degrees to 93.5 per cent of the principals. Of these, the Alabama State College conferred 62.1 per cent of the undergraduate degrees.

Two hundred seventy-two, or 97.1 per cent of the principals have four or more years of college training; 40.7 per cent hold the master's degree; and two principals have had six years of college training.

Two hundred twenty-five, or 80.3 per cent of the principals, have been employed in their present positions one to ten years; 42.5 per cent have previously been principals of schools in which both elementary and high school pupils were enrolled.

The median number of teachers employed in elementary schools previously held by principals is 3.7; the median for combination schools is 5.5 and the median for the largest schools which principals have held is 4.1.

The median number of years of teaching experience for principals who have taught in the elementary school is 4.4; those who were high school teachers have a median of 5.6 years; and principals who have served as combination teachers have a median of 3.6 years of teaching experience. The educational experiences of 91.4 per cent of the principals have been limited to teaching and the principalship.

The following represent the mean percentages of time devoted by principals to various types of activities: teaching 30.8, supervisory 21.9, administrative 21.8, clerical 14.1, and other activities 11.4.

The Bachelor's degree is required of candidates for the elementary school principalship by 73.4 per cent of the superintendents, the Master's degree by 14.9 per cent. Three years of teaching experience are required for the elementary school principalship by 41.9 per cent of the superintendents, five years by 20.2 per cent, and no teaching experience by 10.8 per cent.

The Bachelor's degree is the minimum requirement for certification for the elementary school principalship in Alabama; 29 other states have a similar requirement. The Master's degree is required by 17 of the states. In Alabama 14.9 per cent of the superintendents require the Master's degree for appointment to the elementary school principalship.

The following recommendations are made which might help to improve the elementary school principalship in Alabama:

Requirements for Candidacy

1. Principals should give careful attention during professional study to problems specifically related to elementary education.

2. Candidates for the elementary school principalship should be required to teach in the elementary grades for at least three years before they are eligible for appointment.

3. Elementary school principals should pursue graduate study in professional areas dealing with activities, purposes, and methods in elementary school education.

4. All local school superintendents should require that candidates for the elementary school principalship meet state requirements for the position.

Certification

1. All principals who supervise elementary school children should be required to be certified as elementary school principals.

2. Principals who supervise both elementary and high school pupils should be certified for both elementary and secondary school work.

Promotion of Growth and Opportunities for Contributions

1. The promotion of elementary school principals should be to larger elementary schools rather than to high schools.

2. Elementary school principals should be made cognizant of the opportunities they have to make significant contributions to their schools and communities.

3. All principals should regularly read professional books and magazines.

Miscellaneous

1. More women should be employed as elementary school principals.

2. Teacher units should be assigned to the areas where the children are to avoid overcrowding.

3. Principals should delegate more of their duties to teachers and other school workers.

4. Wherever possible, there should be separation of the elementary and high school grades.

5. Continuous research should be made of the elementary schools in Alabama.

Microfilm $2.60; Xerox $9.00. 197 pages.

STUDENT DECISION MAKING IN SECONDARY SCHOOL EXTRACURRICULAR ACTIVITIES WITH SPECIAL REFERENCE TO PUPIL PARTICIPATION IN FISCAL MANAGEMENT

(L. C. Card No. Mic 59-506)

Ralph John Erickson, Ed.D.
University of Illinois, 1958

Many school administrators believe that student activities may be utilized to teach educational objectives not easily reached in the formal school program. One group of such aims is related to the processes by which these activities are planned, initiated, programmed, staffed, and financed. This wide sharing of responsibility for one's own interests is desirable in the development of the mature personality. When students help manage extraclass activities, they may benefit greatly from learning democratic methods through direct experiences. This study examines high schools to determine if they are using these activities to provide stimulating learning situations which may assist students in becoming increasingly self-directive.

The instrument was administered to all seniors in a representative sample of Minnesota high schools. Student views were sought as to their perceptions of their influence in the operations of these activities, particularly in their financial management. Cost and related values were taken from official sources.

Girls participate much more freely than boys do in publications, music, interest clubs, and speech activities in the majority of schools. Girls are considerably less active than boys in athletics, and somewhat less frequent participants in intramural sports and student government. Although participation is highly variable from school to school and from one activity to another, it increases greatly when schools are small, and the general school expenditure level or district wealth per pupil are high.

Schools report annual mean costs of $102 for maintaining a student in athletics, or $58 in musical activities, throughout the school year. Other activities are very inexpensive. The average cost is $191 for each student who participates in all activities for one year, which is equivalent to $84 per secondary student enrolled. This is a substantial proportion of the total school expenditures.

Large schools spend proportionately less for their activities than do the smaller schools, principally by limiting participation. Costs are greater in the high wealth districts or in those which have many students in activities. Costs are unrelated to the general expenditure level.

Girls claim more influence than boys do in the control and direction of all activities except athletics. In musical activities, publications, and interest clubs this feminine domination is quite extreme. The participants in activities have from two to three times as many opportunities to exercise control measures as do those students that do not take part. Students claim more authority in activities which are centered in the school as class functions, interest clubs, and publications. In all categories students have far fewer responsibilities than they might have.

Student influence increases when a great proportion of the student body is in the activity, the district is wealthy, total activity costs are relatively high, and the school is small. The school expenditure level and the activity costs per student participating are of no value in estimating the quantity of student made decisions.

Minnesota high schools apparently are not relying upon these extracurricular activities in teaching either the elements of good business techniques or the concepts of democratic self-government. Activities seem to be more related to community expectations and traditional practices than to identifiable basic school factors. Typically schools consider these activities are community entertainments or recreational in nature.

Schools might do well to expand many of these activities, making interest the prime criterion for participation. Pupils could be encouraged to assume many more of the details of the financial management of these activities. Such student involvement in activity direction has potentialities for student learning which has been generally neglected in the past. Microfilm $2.40; Xerox $8.40. 183 pages.

THE PREPARATION OF VISUAL INSTRUCTIONAL MATERIALS FOR SELECTED AREAS IN EDUCATIONAL ADMINISTRATION

(L. C. Card No. Mic 59-1099)

Gene C. Fusco, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Erick L. Lindman

The purpose of this study was to devise methods and procedures for preparing visual instructional materials in selected areas of school administration. The study was made in an attempt to improve the preparation program in school administration.

In order to accomplish this purpose: (1) the subject matter of school administration was studied in order to identify areas for which visual materials could be prepared,

(2) questionnaires on the use of visual materials in teaching school administration were sent to selected professors in the Southern region, (3) four types of visuals were prepared by the investigator for professors in school administration at Peabody College, (4) guidelines were proposed respecting the preparation of visuals for classroom and television teaching, and (5) recommendations were made concerning the nature of a local production unit at a college campus.

Findings of the Study

Visual teaching procedures are not new. They have been advocated by educational leaders for many centuries. The use of supplementary visual aids in teaching has been justified on the premise that many concepts are meaningless to students unless perceptual experiences are provided.

Experimental research lends support to the thesis that visual materials which supplement verbal communication may improve the teaching-learning process. Exclusive reliance on lectures as a method of instruction may lead to verbalism.

Questionnaire returns showed that professors in the Southern region were highly interested in employing visual materials in their teaching. However, a lack of such materials and inadequate local production programs have resulted in limited use of this method of instruction.

In selecting areas in school administration that may be effectively taught through visuals, quantitative, pictorial, and representational forms were devised. These forms were based on the nature of the teaching area to be visualized.

Recommendations of the Study

Centralized campus production programs are needed in order that visual materials may be provided professors of school administration. Such a program would function most effectively under the following conditions:

1. Visual materials are prepared for specific teaching areas identified by the professors.
2. An agency is provided to serve as a liaison between the professor requesting the material and the production staff.
3. A graphic arts and photography section are set up for the processing of direct viewing and projected materials.
4. Visuals are prepared as a direct outgrowth of the curriculum objectives in preparation programs in school administration.

Teaching is a form of communication. Recognition of this fact by professors of school administration leads to a commitment to use wisely the devices and techniques currently available for transmitting information. Professors should continually re-examine their methods of presenting subject matter in light of the premise that effective communication and sound teaching procedures are synonymous.

Microfilm $2.65; Xerox $9.20. 203 pages.

A SURVEY OF A CHANGING SCHOOL IN AN AREA OF MOBILE POPULATION

(L. C. Card No. Mic 59-1359)

Ann Trimble Galbraith, Ed.D.
Wayne State University, 1958

Adviser: Ruth Ellsworth

This study came about because of a serious need in one school for experiences which would relate to children's problems of living in an area of mobile population. The searching examination into the area's social conditions led to a crystallization of three beliefs.

The first is that the rapid social change known as urbanization accounts for some of the conflicts and disunity in our culture. As schools are a part of these interacting social forces, it follows that public education has a responsibility to look deeply into these forces and their implications for the school curriculum.

A second belief is that little change in attitudes and behaviors in children can be brought about without the involvement of families, child-focused community agencies, and schools.

The third belief is that in unorganized fringe communities many school experiences have little relationship to the problems of living. It would seem to follow then, that in such areas if change is to be achieved, schools must become the leadership agency.

This dissertation has three purposes: (1) to share with others the action program as it evolved in a particular school community under the leadership of the school; (2) to describe the study area, some leadership-group skills necessary to attempt change in people and some resulting curriculum experiences; and (3) to evaluate some school and area change.

The methodology used in obtaining the documents necessary for the searching examination of social conditions in this community was both subjective and objective. Subjective means were interview and observation. Objective study included examination of school, police and court records; objective also in parent and child questionnaires recorded over a three year period, and in securing teacher evaluation.

The school staff became the medium of change. From this core simple, social experiences were planned involving children, families, and community. These social experiences brought people into groups able to work on some common problems.

The main conclusions obtained from the evaluation were:

1. Behavior problems lessened when children, parents, and school staff cooperatively planned activities more closely related to children's daily problems and fringe-area living.
2. Individualized instruction based on child needs and child interest rather than course-of-study content improved academic skills as measured by standardized tests.
3. Parents enjoyed social contacts made through the school, and these contacts lessened some of the frustrations of rural-to-urban living problems. In questionnaire responses, parents indicated that they felt the changed school program had direct influence upon children's attitudes toward school. Mobile parents cooperated with the school when children took home feelings of enthusiasm and success.

4. The majority of teachers evaluated the area-centered, life-related programs as involving more hours of work, and greater preparation in teaching materials. They recorded less behavior problems, greater job satisfaction and more personal satisfaction through improved relationships with children and parents.

This survey of a changing school program, in an area of mobile population, presents evidence that people in fringe areas will work for their schools and community if the need is identified, problems defined, and the actions guided. The role of the school is to help people articulate their desires for change, and then provide a place and effective guidance for achieving those desires.

Microfilm $2.10; Xerox $7.40. 157 pages.

DELEGATION OF ADMINISTRATIVE RESPONSIBILITIES IN THIRD CLASS SCHOOL DISTRICTS

(L. C. Card No. Mic 59-761)

Edwin Hasson, Ed.D.
The Pennsylvania State University, 1958

The primary purpose of this study has been to identify the minor administrative responsibilities now being performed by the chief school administrator and to determine what organizational pattern is needed to provide for these responsibilities in third class school districts in Pennsylvania.

The data for the study were obtained using the personal interview method. Through the use of the carefully constructed interview sheet, chief school administrators in 30 selected third-class districts in Pennsylvania were interviewed.

The data obtained were processed using the size of the professional staff as the controlling factor. This procedure identified ten small districts with a professional staff of 90 to 127, 11 middle-sized districts with professional staffs between 128 to 165, and nine large districts with professional staff ranging from 166 to over 200 members.

From the data presented in this study, it is possible to form the following conclusions concerning the performance of minor administrative responsibilities in third-class school dsitricts.

(1) The size of the central office staff in the 30 school districts ranged from four members consisting of the chief administrator, director of curriculum, cafeteria manager and head custodian to six members consisting of the chief administrator, director of curriculum, business manager, home and school visitor, cafeteria manager and head custodian.

A uniform staff pattern in the 30 districts can not be obtained from the data presented. There is a tendency towards the employment of a business manager and director of curriculum in all districts and the employment of an administrative assistant and assistant superintendent in the middle-sized and large districts.

Non-professional personnel such as the cafeteria manager, head custodian and business manager accounted for more than half of the personnel making up the central office staff in the 30 third class school districts.

(2) Thirty-seven per cent of the chief administrators indicated a need for personnel to fill the positions of assistant superintendent, director of curriculum, administrative assistant and business manager.

(3) Of the personnel on the central office staff the chief administrator performed more than one-third of the total number of minor administrative responsibilities performed; the business manager, in co-operation with the chief administrator, assumed responsibility for the business affairs of the district and many items related to plant maintenance and supplies; the assistant superintendent and administrative assistant were responsible for items affecting the professional staff, supervision and curriculum improvement.

The chief administrator has utilized the services of non-central office personnel for the performance of many general responsibilities and for the completion of various state reports and records. For example, responsibility for the operation and supervision of the school lunch program has been delegated to the cafeteria manager in the 22 districts employing such personnel.

(4) Minor administrative responsibilities delegated by the 30 chief administrators to other members of the central office staff include items related to classroom visitation, curriculum improvement, cafeteria operation, transportation, items concerning supplies, equipment, reports, records and plant maintenance.

(5) The chief administrator's reluctance to delegate to other central office staff members items affecting the school budget indicates that such items will remain under the control and supervision of the chief administrator.

(6) The chief school administrators stated that they would delegate most of the responsibilities related to the school census, transportation, school plant maintenance, cafeteria operation, supplies, and the completion of certain reports and records.

Recommendations relating to the administrative structure and suggested responsibilities of the central office staff are listed in Chapter VI of the thesis.

Microfilm $2.00; Xerox $7.20. 152 pages.

A STUDY OF THE PRACTICE OF ALTERING OLD SCHOOL PLANTS

(L. C. Card No. Mic 59-1029)

James Thomas Hepinstall, Ed.D.
New York University, 1958

Chairman: Professor Herbert B. Bruner

The purposes of the study were to determine for which reasons, with what effect, and at what cost boards of education complete alteration programs in old school plants in lieu of replacement programs.

In the United States there has existed for some time an enormous backlog of needed classroom construction. Although an extensive school building program was in progress during the 1920-30 decade, a backlog of approximately

120,000 public school classrooms existed at the end of the decade. The depression years (1930-39) saw a further increase in deferred schoolhousing problems. Throughout the defense period (1939-41) and World War II (1941-45) all school replacement, improvement, and maintenance were limited to bare necessities. The postwar era witnessed a further postponement because of the high cost of construction.

In 1958 financial problems caused by rising enrollments, inadequate support, and impediments posed by constitutional and statutory limitations on the authority of boards of education to issue school bonds are responsible for decisions of boards to consider major changes in old buildings as time and progress advance the inroads made by obsolescence and depreciation. Large expenditures have been made in recent years for alterations including remodeling, rehabilitation, and renovation, as well as for the construction of additions.

The problem, as outlined, was initiated after a determination was made that little analytical information concerning either the reasons for preference of alteration procedures or composite results of such practices were available.

The study was limited to ten cities of New York State within 90 miles of Albany. Each chief school officer was asked to identify one elementary school building whose construction antedated 1900, and upon which the board made expenditures in excess of the usual maintenance costs since January 1, 1950.

The chief school officers also supplied information concerning the reasons for making such expenditures in lieu of erecting new buildings. In each selected plant physical measurements were made of the following: illumination, fenestration, area, site, and corridor widths. Observations of sanitary facilities, heating systems, classroom furnishings, and safety aspects, as well as structural conditions were made. In addition the expenditures on the ten old buildings during the eight and a half year period were accounted for:

Analysis sheets, describing ten new buildings of approximately the same capacity which were erected elsewhere in New York State since 1950 were received from the Division of School Buildings and Grounds, New York State Education Department. It was possible to show the relationship of expenditures made for old buildings to the cost of new buildings.

The study revealed that there were numerous reasons reported for proceeding with alteration plans in lieu of replacement programs. Financial reasons were involved in final decisions of all boards. Other reasons given were primarily local ones, and did not necessarily reveal trends or statewide problems.

The altered buildings were all two, and three-story structures of class "B" construction. Five had been extensively renovated since January 1950; one was being completely remodeled in 1958. After alteration all buildings were adequately lighted, had satisfactory sanitary facilities, and were well heated. The element of automatic heat control was missing in three buildings. The absence of two exits from each room, one leading directly to the outside was noted in nine buildings. All visible indications were that the ten buildings were structurally sound. All excepting one site were less than one acre.

Some boards were planning on further alteration of the ten plants; all except one board expected that the altered buildings would be in use for the forseeable future.

Costs of new buildings varied from 1.6 to 59 times the cost of alterations.

Microfilm $2.00; Xerox $5.60. 115 pages.

ADMINISTRATOR ROLES IN SECONDARY EDUCATION AS IDENTIFIED BY SECONDARY PRINCIPALS AND TEACHERS

(L. C. Card No. Mic 59-1424)

Leonard William Holden, Ed.D.
Stanford University, 1959

Supervisor: R. M. Bush

This study examined the role(s) of the secondary school principal as reported by forty-two junior and senior high school principals and one hundred and forty-eight secondary teachers randomly selected from schools in six Puget Sound counties in the western section of the State of Washington. The following factors were investigated: (1) the degree to which reported role perceptions clustered around three suggested divisions of the administrative role, i.e., MANAGING or organizing, HARMONIZING or stabilizing, and MOTIVATING or innovating; (2) comparisons of principals' self concepts with their administrative role perceptions; (3) comparisons of teachers' perceptions of the principal's role with principals' perceptions of their role; (4) techniques and procedures useful in describing administrative role perceptions.

Three testing devices were used in this research design: The "Twenty-Statements" test developed by Kuhn and McPartland; an original series of eighteen open-ended questions entitled, "The Secondary Principals' Opinion Poll"; and, an adaptation of an observation technique and "Personality Word Card," developed and used by Sarbin and Kamiya. The "Twenty-Statements" test, taken by the principals, simple required each respondent to answer in twenty statements the question, "Who Am I?" This test provided information about the principals' self concepts. The Secondary Principals' Opinion Poll, taken by both the principals and teachers, furnished comparative data regarding the reported perceptions of the secondary principal's role. From the combined responses to the eighteen questions, seven categories of responses were established. They were: Personalized Teacher-Principal Relations; Personalized Student-Principal Relations; Personalized Parent or Public-Principal Relations; Impersonal Process and Program Behaviors; Personalized Process and Program Behaviors; Principal Behaviors and Expectations; and, Miscellaneous Responses. Sarbin's "Personalized Word Card," composed of two hundred descriptive adjectives and phrases, (in this study called The Adjective Response Test), provided additional information about role behaviors of the secondary principal as perceived by teachers and the principals themselves. Also, this word list was sorted by fifty-five judges to determine which words were considered most descriptive of the MANAGING, HARMONIZING, and MOTIVATING administrative behaviors. The "Personality Word Card" not only gave information about role perceptions but provided a second measure of principals' self concepts as well as teachers' perceptions of the principals' observed person consistency or inferred self behavior patterns.

The three methods of statistical analysis used in this study were the Chi-square test for significance applied to contingency tables constructed from the variety of self concept and role perception variables produced by the three tests, the t test for significance of the difference between means of teachers' and principals' use of the seven response categories established by the "Principals' Opinion Poll," and simple word usage frequency tables.

The major conclusions of this study were: 1) secondary teachers and principals apparently did not differ generally in their degree of use or dis-use of the categories, MANAGING, HARMONIZING, and/or MOTIVATING, to describe their perceptions of the secondary principal's role(s), self concepts, or inferred self behaviors; 2) teachers and principals did differ significantly in the way they perceived the principal's role as examined by the eighteen open-ended questions in the "Secondary Principals' Opinion Poll," the teachers making more Principal Behaviors and Expectations responses, more Person-centered perceptions, and more Miscellaneous responses, while principals were generally more Process-centered in their role perceptions; 3) principals varied in the salience of their self concepts as measured by the "Twenty-Statements" test which lends support to the validating evidence reported for this instrument by its originators; 4) principals tended significantly to perceive themselves feeling most professional when engaged in Personalized Process-centered Activities; and, 5) teachers and principals did differ in the words selected as well as relative importance of the same words chosen, to report their perceptions of the role(s) of the secondary principal. Microfilm $2.00; Xerox $6.00. 121 pages.

FACTORS AFFECTING THE ESTABLISHMENT OF A SECOND HIGH SCHOOL IN A COMMUNITY

(L. C. Card No. Mic 59-1425)

Erwin Hollitz, Ed.D.
Standord University, 1959

Supervisor: W. M. Garcia

This study was an investigation of the problems which public school administrators face when establishing a second high school. The Monterey Union High School District, located on the central coast of California, was the subject of this investigation. The study deals with three basic factors influencing the establishment of a second school in a growing community; namely, (1) the population growth, (2) the financial structure, and (3) the socio-economic structure of the communities. The investigation concerned itself mainly with the socio-economic conditions needed to construct a realistic background for administrative decision-making related to these specific questions:

1. What are the socio-economic conditions of the schools and community which have educational significance for the problem?
2. What social and economic conditions exist which may help determine how the school district should divide its population between two schools?
3. Can the financial structure of the district support a second high school?

An analysis of community and school conditions provided a number of alternatives whose educational implications became reasonably clear. It was expected that the consequences of the alternatives could also be inferred from the data. The choice of alternatives then became a matter for decision-making and was set apart from the research design.

The underlying assumption of the study was that socio-economic characteristics of a community exert important influences on the education of youth and on administrative decisions related to establishing a second high school. The following conditions were found in the district and weighed heavily in the construction of alternatives regarding the choice of location and attendance boundaries of a proposed second school.

1. The school district communities vary widely in historical background, in social traditions, and in economic well-being.
2. Wide social and economic differences were found to exist in the five communities of the district. The highest rated residential areas have (1) the highest education levels, (2) the highest occupational levels, (3) the highest level of prosperity, (4) the fewest non-white people and, (5) the least delinquency. The data clearly show that a second high school would have a lower social status if attendance were determined by civic boundaries.
3. Relatively uniform attitudes were found to exist among leaders of the community. General agreement was discovered regarding the success and desirability of current integration of youth of different ethnic groups in the schools.

The study concludes with a review of discovered conditions, the recommendations, and a rationale. The author's choice of alternative rests in part on the discovered conditions and in part on his social philosophy. Alternative D was chosen for several compelling reasons, here summarized.

1. The possibility that the new school will stand in grossly inferior social relationship to the present high school is avoided.
2. The alternative takes into account community attitudes which limit the freedom of administrative choice.
3. A large center of population can be served by this alternative, taking into account long-range municipal planning, and anticipated population growth.
4. Alternative D unites neighborhoods of three separate municipalities into one attendance area, thus giving these communities a common interest in education of their youth.
5. It avoids a disproportionately large number of social and educational problems being centered at one school.
6. The growing racial, ethnic, and laboring groups would be divided between two schools. Each school would have the full range of social classes existing in the district in reasonable proportions that are not far different from the district as a whole.

Microfilm $3.00; Xerox $10.40. 232 pages.

AN EXPERIMENTAL EVALUATION OF TWO DIFFERENT PROGRAMS OF TEACHING HEALTH IN THE SIXTH GRADE AND THE ADMINISTRATIVE IMPLICATIONS INVOLVED

(L. C. Card No. Mic 59-1274)

Arthur Myron Jensen, Ph.D.
University of Minnesota, 1958

Adviser: Palmer O. Johnson

Statement of Purpose.--This study was designed to test out whether or not either of two treatments using the same curriculum content in health education would result in changes that were statistically significant. Two achievement tests and two atttitude inventories were employed for the evaluation. The study was carried out with all the sixth grade pupils in the Tuttle Elementary School of Minneapolis for a two-year period. Another aspect of the study was to examine the evidence for administrative implications which might provide a quantitative basis for making decisions relative to the merits of each treatment in health education.

Investigation of the Population.--This was accomplished by selecting samples over an undefined period of time by testing certain hypotheses related to the means and variances for ability and reading comprehension. A modification of Welch's L_1 test was used to test the homogeneity of the variances and the analysis of variance for testing the equality of the means. The classes were found to be homogeneous for a three-year period with respect to intelligence but not for reading. However, the unrestricted randomized design accounted for the inequalities in reading which permitted generalizations regarding the selection of the samples.

Evaluation Instruments.--One achievement test was constructed and used and one commercial test was used to evaluate achievement. Careful attention was given to: item analysis, defining validity, testing out reliability and exploratory testing for the constructed test. Two inventories of attitudes were constructed, one for parents and one for children. These were developed for the study and pretested.

Instructional Methods or Treatments.--A year's work for each of a two-year period was planned with the cooperating teachers. The unit arrangement of curriculum was designated as the experimental and the integrated as the control. Each teacher kept a log of her activities in health education for the first year and exchanged this information the second year for use in the contrasting treatment since each teacher taught by each method in alternate years.

Design and Tests of Significance.--The pupils were randomly assigned to the classes for each year. Teachers were randomly assigned the first year and taught by the contrasting treatment the second year. This provided the means whereby an extention of the unrestricted randomized design could be used and by adding a third factor to the design, (intelligence) a three way classification system was employed for analysis of the data. The analysis of variance and covariance provided the means for studying the effects and interactions. However, the absolute gains were analyzed by appropriate t-tests on the means and variances. These tests considered the correlated nature of this data. Data obtained from the inventories were analyzed by means of the Chi-square tests of independence for response by treatments of pre- and post-testing. A fixed model effect was also employed for this purpose using the Chi-square distribution. The 5 per cent level of significance was used for this study throughout.

Findings:

1. Significant gains were found on the means for each achievement test between pre- and post-testing but the variances were reduced.
2. The following hypotheses were tested:
   a. Teachers are equally effective
   b. Treatments are equally effective
   c. Pupils of differing abilities have equal achievement
   * d. There is no teacher by treatment interaction
   e. There is not treatment by I.Q. interaction
   f. There is no teacher by I.Q. interaction
   g. There is no teacher by treatment by I.Q. interaction

* Confounded by year differences.

All the hypotheses except (c) were not significant.

3. Both attitude inventories showed some promise, but further refinement of the instruments was indicated by the results. Microfilm $5.70; Xerox $20.00. 446 pages.

AN OPINION POLL ON ATTITUDES OF WHITE ADULTS ABOUT DESEGREGATION IN THE PUBLIC SCHOOLS OF KNOXVILLE, TENNESSEE

(L. C. Card No. Mic 59-1106)

Douglas Rupert Jones, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Harold D. Drummond

The purpose of the study was to survey and analyze the attitudes of white adults in regard to desegregation in the public schools of Knoxville, Tennessee. An attempt was made to show the strength of the feeling regarding desegregation in the public schools.

In order to accomplish the objectives of the study, the researcher conducted an investigation which included the following procedures:

1. The literature on desegregation in the public schools was surveyed.
2. Personal interviews were conducted with 167 persons, chosen by an unbiased area sampling procedure, in order to determine opinions held by white adult citizens on the problems of desegregation in the public schools of Knoxville, Tennessee.
3. The official statements, editorials, board action, and newspaper articles concerning desegregation in Knoxville, Tennessee were reviewed.

Findings of the Study

Of the 167 persons who were interviewed, nearly 77 per cent classified themselves as favoring segregation. Every person who was interviewed stated that he had given attention and thought to the question of desegregation in the Knoxville public schools. Over 90 per cent of the prosegregationists strongly disagreed with the idea of teaching white and Negro children in the same classroom.

Forty-four per cent of the subjects objected to desegregation, but indicated that they would accept whatever plan the school board accepted. About 40 per cent of the respondents who favored segregation believed that children withdrawn from public schools should be placed in private schools. A majority of the prosegregationists disagreed with any ratio of white children being enrolled in a school with Negro children. Only 6.3 per cent of the prosegregationists stated that they would use violence to keep Negroes out of the schools for white children. If desegregation should become inevitable, the respondents favored a gradual plan, such as the desegregation of the first grade each year, as the best solution for the Knoxville public schools. Analysis of the answers given by the 128 prosegregationists revealed that strong feelings existed toward desegregation of the public schools of Knoxville, Tennessee.

Twenty-five of the 167 respondents classified themselves as favoring desegregation. The entire group of desegregationists agreed with the idea of teaching white and Negro children in the same classroom. Nevertheless, 64 per cent did not agree with placing one or two white children in a school of predominantly Negro population. Eighty-eight per cent of the desegregationists, however, were in favor of placing children in schools with equal percentages of the two races. Every desegregationist indicated that he would accept one or two Negroes in a school for white children. A majority of the respondents indicated that gradual desegregation of the public schools would be better than complete desegregation at one time.

Conclusions

The following conclusions were made as a result of the study:

1. Education played an important part in softening the attitudes of the people toward desegreation.
2. Inconsistencies were noted in the information obtained from the prosegregationists about desegregation.
3. Maximum conditions of desegregation would not be acceptable to the people of Knoxville, Tennessee.
4. Several agencies were found to be working toward desegregation in Knoxville, Tennessee.
5. Strong feelings toward the issue of desegregation were shown by both the prosegregationists and the desegregationists.
6. The plan selected by the school board should be permissive in nature.
7. The influence of the family must not be overlooked by the board and administration as a plan of desegregation is instituted.
8. Community resources must be used to help cope with the problems of desegregation.
9. Neighborhoods make a difference in attitudes of white citizens toward Negroes.

Microfilm $3.85. Xerox $13.00. 299 pages.

THE COORDINATION OF INSTRUCTIONAL, ADMINISTRATIVE, AND STUDENT PERSONNEL SERVICES IN PENNSYLVANIA'S STATE TEACHERS COLLEGES

(L. C. Card No. Mic 59-765)

Samuel Murray Long, Ed.D.
The Pennsylvania State University, 1958

The Problem. The purpose of the study was to discover the manner and extent to which administrators of student personnel services, other college administrators, and faculty members in Pennsylvania's State Teachers Colleges work in an organizational structure to accomplish the objectives of student personnel services.

Specific problems were to determine: (1) what student personnel services were provided, (2) the extent to which student personnel services were coordinated with instructional and other administrative services, (3) who were responsible for providing or coordinating the services, (4) how the student personnel services meet the standards of best practices which were established for the study, and (5) a proposed plan for the over-all coordination of student personnel services in accordance with the standards of best practices.

The Procedure. A review of the literature pertaining to student personnel services in colleges was made for the purposes of: (1) discovering previous research related to this study and (2) establishing criteria for evaluating the student personnel services in Pennsylvania's State Teachers Colleges and developing a plan in accordance with the criteria for the over-all coordination of these services within these colleges.

Data were collected by means of questionnaires which were used as interview schedules and filled out when the author of the study visited each of these colleges.

The Conclusions. The student personnel services in all of the State Teachers Colleges of Pennsylvania included: established procedures for recruitment and admissions, freshman week activities, standardized testing programs, placement, housing, food, and health services, financial, extra-class, and religious programs, opportunities for student government, established procedures for maintaining student personnel records and administering discipline. Three fourths of the colleges conducted freshman orientation courses and faculty advisory programs. More than half of the colleges provided remedial services in the areas of emotional adjustment, speech, reading, and study techniques. One fourth of the colleges provided for research and evaluation of student personnel services.

Recruitment and admissions should be on a selective basis and the designated responsibility of an individual. Various approaches should be used in recruitment programs and more faculty members and students should participate. Approximately half of the colleges administered a sufficient number of standardized intelligence and achievement tests to obtain a multiple predictive index of academic ability. All colleges which do not now provided pre-admissions counseling for students should do so.

Freshman orientation programs should be improved in most colleges by lengthening the time for freshman week activities and by providing counseling services by upperclassmen for freshman students. All colleges which do not now provide freshman orientation courses should provide them. Over-all coordination of freshman orientation programs in all colleges is needed.

Some colleges provide faculty advisory programs; all should do so. All colleges should provide in-service training programs for faculty advisers.

A majority of the colleges have met, in most respects, the criteria pertaining to student housing and placement. Only a minority of the colleges have follow-up studies of graduates. All should have these programs.

Only a few colleges plan for effective coordination of health services and extra-class activities and for administering student financial aid; all should do so. All of the colleges should establish policy-making committees for student discipline. Few colleges have established central files of student cumulative records. These records are needed in all colleges.

In accordance with the criteria which were established for this study, a Director of Student Personnel should be appointed to coordinate the over-all student personnel program and the work of the Deans of Men and Women and the Directors of Recruitment and Admissions, and Placement. A Student Personnel Council should be appointed and charged with the responsibility of formulating policies and performing research and evaluation of student personnel services. Microfilm $5.40; Xerox $19.00. 421 pages.

AN ANALYSIS OF TRAINING NEEDS OF COUNTY EXTENSION AGENTS IN OHIO

(L. C. Card No. Mic 59-1174)

Robert William McCormick, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Gale L. VandeBerg

The two general purposes of this study were: (1) to analyze the training needs of county Extension agents in Ohio, and (2) to develop procedures and questionnaires which would be useful in securing the self-expressed needs of county agents relative to training.

Nine areas of competency, identified by the National Task Force on In-Service Training, formed the framework for this study.

Data were collected by group interviews in the summer of 1958 from the 241 county Extension agents in Ohio.

Summary and Conclusions

1. The Ohio Extension Service has selected its personnel most heavily from the undergraduate areas of agricultural and home economics education.
2. Sixteen percent of the Ohio agents had earned master's degrees.
3. Eighty percent of the Ohio agents perceived their role as that of an educator.
4. Supervisors had a tendency to rate the job performance of Extension agents higher than was objectively true.
5. It was not necessary for an Ohio agent to perceive his role as educational in order to receive the highest job performance rating from his supervisor.
6. Undergraduate training in agricultural or home economics education increased the probability of an agent perceiving his role as educational during his first year of service.
7. Graduate training increased the probability of an agent perceiving his role as that of an educator.
8. Agents with five to twenty years of tenure were more likely to perceive their professional role as educational than agents in other tenure groups.
9. Significantly more of the agents who had completed twenty quarter hours of graduate training were rated in the highest job performance group than agents with less graduate training.
10. Ohio agents were highly favorable towards their supervisors using the questionnaire developed in this study as a device to counsel with them on training.
11. The rank order of the nine areas of competency on the basis of training Ohio agents said they needed was: (1) program planning and development, (2) effective thinking, (3) communication, (4) technical knowledge, (5) human development, (6) research and evaluation, (7) the educational process, (8) understanding social systems, and (9) Extension organization and administration.
12. There was low correlation between the areas in which the agents expressed a need for training and the areas in which agents indicated they planned to take graduate training and request in-service training.
13. Supervisors could predict quite well the average training needs of all the agents in their district but could not predict the felt training needs of individual agents.
14. One district in Ohio had much higher congruency of supervisors' and agents' opinions on the training needs of agents than did the other three districts.

Recommendations

1. Concentrate recruitment activities on personnel who have an undergraduate major in agricultural or home economics education.
2. Develop more objective guides for the supervisors' job performance rating of agents.
3. Encourage and train supervisors to use the questionnaire developed in this study as a counseling aid with agents on their training needs.
4. Use the questionnaire developed for this study with a random sample of agents in each district to identify in-service training needs.
5. Make available the information on training needs of agents to the major advisor of each Extension agent engaged in graduate study.
6. Study the procedures used by Ohio supervisors to identify why one district had a much higher congruency of opinion between supervisors and agents on agents' training needs.
7. Conduct controlled research studies on the effect of various induction and orientation training programs upon the job performance of agents.
8. Conduct research for the purpose of identifying the training needs of specialists and supervisors.

Microfilm $3.30; Xerox $11.20. 255 pages.

PERCEPTIONS OF THE IDEAL AND ACTUAL ROLE OF THE ELEMENTARY SCHOOL PRINCIPALSHIP

(L. C. Card No. Mic 59-1366)

Joseph Melton, Ed.D.
Wayne State University, 1958

Adviser: Charles L. Boye

The general purpose of this study was to determine role perceptions of elementary school principals employed in Wayne County, Michigan excluding Detroit.

Specifically, answers were sought to the five following basic questions:

1. What do Wayne County elementary school principals perceive as their ideal role?
2. What do Wayne County elementary school principals perceive as their actual role?
3. What are the similarities and differences between the ideal perceptions and the actual role demands of Wayne County elementary school principals?
4. What influence do sex, number of years of experience, and the economic rating of the community have on the principal's perceptions of his ideal role and his role in actual practice?
5. How do Wayne County elementary school principals feel about training for the principalship; blocks to instructional leadership due to administrative details; selection of superintendents, assistant superintendents, and board members; certification for teachers and principals in Michigan; and the principalship as a life career?

A resume was made of the historical development of the principal's role, the complex and expanding nature, and the "time versus job" situation in which today's principal functions.

Positive statements describing the various aspects of the principal's job were drawn from many sources and placed in the following six major categories:

I. The Principal's Role in Curriculum and Instructional Leadership
II. The Principal's Role in Personnel Guidance
III. The Principal's Role in School-Community Relations
IV. The Principal's Role in Administrative Responsibility
V. The Principal's Role in Evaluation Responsibility
VI. The Principal's Role in Professional Improvement.

Each statement was placed on separate cards in six groups to facilitate a modified Q-sort technique.

A representative panel of judges helped refine the instrument and establish validity. The final instrument contained one hundred-twenty categorized statements describing the principal's job.

The instrument was pre-tested with principals like those used in the sample. A stratified-proportionate-random sample of thirty elementary school principals was used.

"Sample" principals filled out personal data sheets and sorted the cards twice according to their perception of the ideal role of the principalship and according to their perception of what they were actually doing. An interview schedule was formulated to follow-up the two Q-sorts.

Statements were clustered for each category into the following groups: five ideal-more important, five ideal-less important, five actual-more important, and five actual-less important.

Ten significant differences using the chi-square statistic were found by comparing what the principal thought should be done ideally and what was actually done. Another ten comparisons were not significantly different. Four comparisons were doubtful. The data classified according to sex, years of experience, and economic rating did not indicate any statistically significant differences.

Findings in this study revealed: what principal's thought were the ideal- and actual-more important perceptions in the six major categories used; an enumeration of administrative details which curtailed principals' attention to instruction and curriculum matters; and a wide disparity between ideal and actual perceptions in the areas of instructional leadership and community relations in terms of time spent.

Principals advocated carefully planned internships, employment of additional personnel, and improvement of central office operations as remedies for releasing the principal for instructional purposes. They further proposed more considered selection of board members, superintendents, and assistants.

Implications and needed research were directed toward change-producing action beyond identification and verbalization phases. Microfilm $3.30; Xerox $11.20. 255 pages.

A STUDY OF THE ADMINISTRATION OF SELECTED ELEMENTARY SCHOOLS IN THE STATE OF INDIANA IN RELATION TO CERTAIN DEMOCRATIC PRINCIPLES

(L. C. Card No. Mic 58-5210)

Clyde Moyers, Ed.D.
Indiana University, 1958

Chairman: Hanne J. Hicks

Thesis: A Study of the Administration of Selected Elementary Schools in the State of Indiana in Relation to Certain Democratic Principles.

Problem: To investigate the use of certain democratic principles in elementary schools in Indiana and to analyze the factors that retard or prevent the development of democratic practices by elementary school faculties.

Procedure: Information concerning the observance of democratic practices in school administration was obtained through the use of two questionnaires. The first questionnaire was sent to non-teaching principals of 156 schools and the second was directed to a 40 per cent sample of the teachers in these schools. Eight democratic principles concerning the areas of leadership, organization, and evaluation were formulated. Certain questions were asked in conjunction with the principles to provide an opportunity for teachers to indicate the extent to which certain democratic practices are observed. Principals were given the opportunity to specify the extent to which these practices should be observed. Teachers and principals were requested to indicate if specific factors that retard the development of democratic school administration are to be found in their schools.

Conclusions: The major conclusions are: (1) specific practices of leadership are conducted in a more democratic

manner than are those of organization and evaluation; (2) there is, and should be, greater modification of the program for all elementary schools within the school system as a result of the study of general committees than is found in the individual school program as a result of study by the faculty; (3) a greater percentage of men than women consider that specific factors that retard the development of democratic practices are to be found in their schools; (4) elementary school principals believe that conclusions arrived at by the faculty are reached in a more democratic manner than do the teachers themselves; (5) approximately one-half of the principals and 40 per cent of the teachers believe that it would serve a constructive purpose for the faculty to devote more time and effort to group activities that concern the elementary school program; and (6) there is, and should be, a tendency toward the development of more democratic attitudes, beliefs, and procedures.

Recommendations: It is recommended that:

(1) There should be a greater diffusion of leadership among members of the faculty.

(2) Administrators and supervisors should emphasize a service relationship rather than an authoritarian one with teachers.

(3) Faculty meetings should be conducted in a democratic manner.

(4) Teachers should be given the opportunity to participate in developing solutions to administrative as well as instructional problems.

(5) Faculty members should have the opportunity cooperatively to evaluate the administrative and supervisory policies of the school.

(6) There should be a greater cooperative effort on the part of the faculty to improve the instructional program.

(7) Faculty members should prepare themselves for democratic participation in school administration.

(8) Additional time and effort should be devoted by the faculty to group activities that concern the school program.

(9) Elementary school principals should have greater preparation for leadership.

(10) Principals should encourage teachers to take part in the administration of the school.

(11) Requirements for the elementary school principalship should be studied and revised as needed.

(12) The superintendent of schools should grant the elementary school principal greater authority to share the responsibility and authority for the individual school program with the faculty.

(13) All school personnel should endeavor to develop more democratic attitudes, beliefs, and procedures within their school and school system.

Microfilm $4.95; Xerox $16.60. 387 pages.

PLANNING SOCIAL STUDIES FACILITIES FOR SECONDARY SCHOOLS

(L. C. Card No. Mic 59-1426)

Glen Fowler Ovard, Ed.D.
Stanford University, 1959

Supervisor: J. J. MacConnell

The Problem

The purpose of this study is to develop the educational specifications for social studies facilities for secondary schools.

Procedures

Critical reviews of school planning materials, major social studies textbooks, and curriculum guides were made in order to further familiarize the writer with latest developments in school planning, and in the social studies aims and objectives, curricula and activities. Selected schools were visited and interviews were held with teachers. Based on an analysis of the above data, tentative educational specifications were written. These specifications were submitted to 115 qualified jury members consisting of administrators, state directors, public school supervisors, university professors, and secondary school teachers. Of this number, sixty-nine per cent evaluated the specifications.

Conclusions

Conclusions for the specific items can be obtained by referring to Chapter VII. A summary of the general conclusions is presented below:

1. The general statements of the aims and objectives, curriculum, and activities were strongly approved by the jury.

2. The two basic floor plans which indicated the amount of floor space for each area and the orientation of the basic areas and the facilities as presented in Figures 9 and 10 were approved.

3. A classroom of 900-1000 square feet is needed for a class size of 28-32 students. If class size should be increased the total square feet should be increased by multiples of the basic plan rather than by the average square feet per person.

4. Based upon the suggested activities, the following general areas are needed: student station, primary teaching bulletin board display, creative-project, open display and exhibit, lockable display, classroom research, group planning-consultation, and storage.

5. Both the supply and equipment items and the drawing, Figure 5, of the teaching storage which presents the number, size of spaces, and relative locations of spaces were approved.

6. The size and design of the creative-project room and the student planning-consultation room were approved.

7. The map-display rail with its accompanying hooks and clips was considered to be a desirable method of displaying and storing maps, audio-visual screens, charts and other similar materials.

8. The provisions for chalkboard, tackboard, pegboard, student desks, classroom furniture, basic maps, globes,

charts, books, newspapers, magazines, pamphlets, documents, pictures were satisfactory. Storage of these materials was indicated in Figures 5 and 6.

9. Provisions for heating, ventilating, acoustics and utilities were accepted as adequate by the jury.

10. Flexibility provisions, such as, size of the classroom, movable furniture and storage units, were approved by the jury.

11. The lighting provisions should be the type in which background brightness would never exceed task brightness or be less than a one to one-third ratio. Modelling shadow contrasts should not be less than three to one to not more than seven to one.

12. Color should be used to aid in controlling the brightness ratio. Both the students and the work that they produce, strike dominant color notes; therefore, the rooms should be predominantly neutral and quiet, and the number of colors in a room should be limited to one or two and not more than three.

13. The criteria and drawings, Figures 11, 12, 13, 14, for the departmental supplies and equipment were approved by the jury. A few additional items were suggested by jury members.

14. The social studies classroom should be located: close to the departmental storage and other social studies classrooms; near the library and a large projection room, and not too far from the other academic classrooms. Refer to Figure 3.

Recommendations.

It is recommended that the final educational specifications be published and made available to those who are planning social studies facilities for secondary schools.

Microfilm $3.45; Xerox $11.80. 267 pages.

A STUDY OF THE DIFFUSION OF INFORMATION WITHIN SECONDARY SCHOOL STAFFS

(L. C. Card No. Mic 59-1350)

Sidney Philip Rollins, Ph.D.
Washington University, 1958

Chairman: Adolph Unruh

This was an exploratory study of the diffusion of information within public secondary school staffs. The purposes of the study were two-fold: (1) to discover additional knowledge concerning how information that is disseminated by principals is circulated through their staffs, and (2) to discover if those who are the intended recipients of information do indeed receive it. Since most of the available research in the area of communications has been the result of the work of psychologists and social-psychologists, studies in the behavioral sciences were utilized and related to the secondary school setting.

The two hypotheses investigated were (a) "the greater the saturation of communication contacts in a secondary school, other things being constant, the greater the diffusion of an item of information," and (b) "the greater the 'span' of input subjects in first, second, and third order matrix computations, the greater the diffusion of an item of information." ("Span" refers to the number of reciprocated communication contacts in which an individual participates.

The investigation, conducted during the spring of 1958, was divided into three phases. The first concerned the investigation of saturation of communication contacts among staff members in secondary schools. Subjects schools were located in St. Louis County, Missouri. The second phase concerned the measurement of span of input subjects, and the third concerned the investigation of the diffusion of two items of information.

The Staff Communications Questionnaire was employed to gather data concerning the saturation of communication contacts among secondary school staff members. Staff members were asked to list the names of other staff members with whom they talked, and the frequency with which they talked with the persons they had indicated. Data were tabulated in matrix form. Cell entries showed the frequency of any reported contact according to a scaled code. Only reciprocated "nominations" were considered in this study. The degree of saturation was computed by dividing the number of actual reciprocated "nominations" by the total number possible.

Information concerning the diffusion of information was gathered by means of the Survey of Information Flow questionnaire. Three days after the injection of each of the information items the questionnaires were distributed to each of the staff members in each of the subject schools. Each staff member was asked to check whether or not he had heard all or part of the information, and given space to record information which was different from the original items. Those staff members who indicated that they had heard the information were asked to indicate when they had heard it, from whom they had heard it, and to whom they passed on the information. This provided data which were used to check the patterns and directions taken by the information items as they were diffused through the staff.

The saturation-diffusion hypothesis was not confirmed. The span-diffusion hypothesis tended to be confirmed. Using the Chi-square test corrected for continuity, differences between high and low saturation schools, and between input subjects appeared statistically significant beyond the .01 level of confidence. It must be pointed out, however, that the results of the present study were derived from a relatively small number of cases. Until more data concerning the diffusion of information has been gathered, the results of studies of this particular facet of communications may not be generalized to all secondary schools.

Since the saturation-diffusion hypothesis (hypothesis "a") was not confirmed, it appeared likely that factors other than saturation influenced the diffusion of information among the selected public secondary school staffs. The sources of possible suggested explanations are (a) structural features of secondary school staffs, (b) characteristics of the communicator's role, and (c) aspects of message content. There were discussed at length.

Results of this study contain several implications for secondary school administrators:

1. A measurable communications structure exists in each school staff.
2. This structure operates to diffuse information, although the manner in which it operates is not yet fully clear.
3. Administrators cannot assume that when they have given an item of information to one staff member verbally, all other staff members will hear it.

4. Content appears to have an important effect on the diffusion of information.
5. Attitudes of staff members toward their own and the principal's functional roles in the communications structure may affect the diffusion of information.

Microfilm $2.00; Xerox $4.20. 77 pages.

A NATIONAL STUDY OF BUSINESS MANAGEMENT IN CENTRAL CATHOLIC HIGH SCHOOLS

(L. C. Card No. Mic 59-918)

Brother Leo Vincent Ryan, C.S.V., Ph.D.
St. Louis University, 1958

This dissertation presents the outcomes of a detailed investigation of business management practices in one segment of Catholic secondary education, namely, the central Catholic high school. A central Catholic high school is one which is designated as such by the Bishop. Its funds and administration are under diocesan or multiple parish control. The study (1) reports the information gathered in a national survey; (2) relates these data to generally accepted practices in school business administration; and (3) identifies the areas in central Catholic high school business management which require improvement or additional research.

The investigation was founded mainly upon: the title, length of service, and the educational and experience qualifications of the persons who perform the school business functions, and especially the duties performed by business managers in relationship to budget preparation and administration; financial accounting and financial reporting; purchasing; personnel administration; school plant operation and maintenance; office and cafeteria management; faculty housing and feeding; activity fund administration; and miscellaneous functions.

The procedure followed in this study included: (1) a preliminary survey of the problem area through library research, conferences with school administrators, and correspondence with representatives of national organizations interested in school administration; (2) the preparation and verification of a directory of central Catholic high schools in the United States; (3) a pilot study which consisted of visits to twenty-seven central schools located in twenty cities, thirteen archdioceses or dioceses, and seven mid-western states, and of detailed interviews with the principal or business manager; and (4) the tabulation and examination of data obtained through a questionnaire mailed to 340 central schools in operation in the United States during 1955-1956.

The mailed questionnaire yielded 192 responses (56.47 per cent) by January 5, 1957. Of these responses, 136 were from administrators in schools classified as central schools according to the definition used in the study. These replies served as the basis for the present study. Tabulations of data were prepared on International Business Machines equipment.

The data suggest that the persons who perform the business functions in central Catholic high schools are zealous administrators, professionally prepared for their responsibilities as educators, but inadequately trained for their responsibilities in school business management. The study reveals insufficient planning, incomplete organization, and informality of control. Many of these deficiencies appear to be traceable to the absence of formal preparation of administrative personnel for their business responsibilities. The study also reveals a lack of uniformity in terminology and in procedures; the frequent failure to employ standard procedures in accounting, budgeting, purchasing, and personnel administration; inadequate employee training; and relatively little attention to the role of parents and to the values of public relations in school business management.

The dissertation recommends specific improvements in the following directions: the assignment of responsibility for business functions; the formulation and recording of policies; terminology; business procedures; budgeting; purchasing practices; auditing methods; payroll administration; financial reporting; employment techniques; employee training and evaluation; and employee benefit programs. Microfilm $11.55; Xerox $41.20. 913 pages.

FIRE INSURANCE ON PUBLIC SCHOOL PROPERTY IN PENNSYLVANIA

(L. C. Card No. Mic 59-780)

George E. Taylor, Ed.D.
The Pennsylvania State University, 1958

I. PROBLEM

The problem of this study was to investigate the practices, policies, and cost-loss ratios of fire insurance by public school districts of Pennsylvania and to determine in what ways fire insurance can be secured most effectively and most economically.

II. SUMMARY OF STUDY PROCEDURE

This study investigated the general field of insurance, its origin and development, the nature and definition of insurance, the law and contractual status of fire insurance, and the Pennsylvania State Standard Fire Insurance Policy. A total of five Pennsylvania studies and eighteen studies from other states, all related to the problem of this study, were identified. This study investigated the five states, South Carolina, Wisconsin, North Dakota, Alabama, North Carolina, that have self-insurance programs. A questionnaire was prepared to determine the practices and policies currently in operation among the school districts of the state. The questionnaire also was constructed to obtain actual property evaluation, premium expenditures, and fire losses for the past school year. School officials were asked to express an opinion regarding a self-insurance plan, and also to indicate their preferences for one of two plans. The annual Statistical Reports of the Pennsylvania State Superintendent of Public Instruction and cost-loss ratios in the office of the Pennsylvania State Insurance Commissioner were reviewed for costs and losses.

III. FINDINGS AND CONCLUSIONS

1. The returns of the insurance questionnaire represent 66 per cent of the 790 administrative school district units in Pennsylvania. All school districts

carry fire insurance except Pittsburgh which is self-insured.

2. Of the remaining 522 school districts 52 per cent carry all of their fire insurance with stock companies. Eighteen per cent of the school districts carry all of their fire insurance with mutual companies. An additional 32 per cent carry insurance in both stock and mutual companies.
3. Four hundred thirty-five school districts reported an average cost-loss ratio of 30.18 per cent for the year 1956-57.
4. Fire insurance rates on public school property in Pennsylvania are unduly high and should be reduced or the schools of Pennsylvania should support legislation to permit self-insurance on public school property. Studies conducted both nationally and in individual states have concluded almost universally that schools are paying higher rates for fire insurance than are warranted by the losses sustained. State self-insurance plans have proved successful and have furnished adequate fire insurance coverage for school property for less cost than that provided by commercial companies. In general, Pennsylvania school districts would seem to be administering the school fire insurance program through good management, practices, and policies.
5. Public schools are a preferred risk. The conclusion is based upon cost-loss ratios of public schools, for a twenty-five year period, 1930-1955, and of a one-year period, 1956-57, for 435 Pennsylvania school districts compared to cost-loss ratios of Educational Institutions.
6. The public school officials of Pennsylvania favor self-insurance.

IV. RECOMMENDATIONS

It is recommended that:

The Pennsylvania State Insurance Commissioner be petitioned to maintain a separate classification for public school buildings and content for fire and fire losses.

The data in this study relating to cost-loss ratios be presented to the Middle Department Association of Fire Underwriters with the request that rates for fire insurance for public school buildings and contents be reduced accordingly.

If fire insurance rates are not reduced for public school property, legislation should be enacted to permit the establishment of a state insurance program covering public school property.

Microfilm $2.40; Xerox $8.40. 184 pages.

MEASURES OF LOCAL FISCAL ABILITY TO SUPPORT PUBLIC SCHOOLS

(L. C. Card No. Mic 59-1373)

Allen Burton Wetherington, Ed.D.
North Texas State College, 1959

The problem of this study is a comparative evaluation of three measures of fiscal ability to determine which would be a more equitable and valid measure of the relative taxpaying ability of Arkansas counties to support a foundation school program. The proposed measures to be evaluated are:

1. A measure based on the 1957 Arkansas Sales Ratio
2. The county ability index in the current Arkansas Foundation Program Law
3. A measure based on the 1957 effective buying income of Arkansas counties.

Primary purposes of this study are: first, to summarize the writings of specialists concerning the nature, source, control, and measurement of local fiscal ability; second, to develop a theoretical evaluation of the "bases" of the proposed measures; third, to develop a criterion of relative taxpaying ability of counties in terms of actual valuation of real property; and fourth, to determine through statistical evaluation the significance of the association among the measures and the degree of relationship of each measure to the criterion. The assumption is made that actual valuation of real property is a sound basis for a criterion of the relative fiscal ability of local taxing units to support public education.

Consistent with the purposes of the problem, two hypotheses are proposed. They are: first, there is no association among the three measures which is not due to chance; and second, one of the measures is more equitable and valid than the others as a substitute for the criterion for determining the relative taxpaying ability of Arkansas counties to support a foundation program.

Procedures used in this study include content analysis, integrative research, and statistical appraisal techniques, Quotations by specialists which are judged to have significance concerning the evaluation of measures of local fiscal ability are synthesized. A theoretical evaluation of the "bases" of the measures in terms of related literature, empirical analysis, and criteria are developed. The basic assumption is evaluated and a criterion based on actual valuation of real property is calculated for each county. Finally, basic data concerning the measures are presented, and the statistical evaluation is developed.

Among the major findings a chi square test for multiple-cell tables shows that the null hypothesis can be rejected at the 71 per cent level of significance. In terms of "goodness of fit" tests, the average error from the criterion is 10.76 per cent for the measure based on the sales ratio; 15.1 per cent for the county ability index; and 22.6 per cent for the income measure.

The correlation of the criterion and the sales ratio measure shows an $\bar{r}$ of .972 with a significance level of 5.74 per cent relative to the hypothesis that $\bar{r} = .75$; for the county ability index the $\bar{r}$ is .931 with a significance level of 12.1 per cent; and the income measure has a correlation of .928 with a significance level of 13.4 per cent.

Following are two major conclusions: first, the correlation among the three measures is significant at the 71 per cent level; and second, the measure based on the

sales ratio would be more equitable and valid than either of the other two as a substitute for the criterion for determining the relative taxpaying ability of Arkansas counties.

The study recommends that a measure of relative fiscal ability based on total valuation of real property of Arkansas counties be developed and proposed to the Arkansas Legislature to replace the present county ability index.

Microfilm $2.50; Xerox $8.80. 191 pages.

THE RELATIVE DESIRABILITY OF TWO TYPES OF JUNIOR COLLEGE OPERATION

(L. C. Card No. Mic 59-1374)

Talmadge Thayne White, Ed.D.
North Texas State College, 1959

The problem of this study was to determine which of two types of junior college organization would best meet the educational needs of the citizens of Dallas County, Texas.

The following two types of junior college organization were considered:

1. A junior college operated by the Dallas Independent School District.
2. A junior college operated on a county-wide basis.

Two studies were made and the two situations were then compared in an effort to determine the relative desirability of each.

A detailed and exhaustive review of the literature from 1920 through 1958 was made. Criteria were established from the review of the literature.

Three instruments were constructed for the purpose of gathering data pertinent to this study. One questionnaire was given to each student who graduated in the spring of 1958 from a high school within the fifteen independent school districts studied. The second questionnaire was given to the parents of each of the graduates. The third questionnaire was constructed in order to obtain data from each of the superintendents of the fifteen independent school districts.

A projected junior college enrollment was made and the cost of junior college education for students from each of the districts was determined. Considering the two situations, the increase in school tax rate necessary to produce the equivalent amount of the cost of a junior college education for the students of each district was determined.

It was found that, other factors being almost equal, the cost of operating a local public junior college on a county-wide basis would be slightly favorable to twelve of the fifteen districts.

The over-all difference, however, in the cost under the two compared situations was found to be too slight to be a deciding factor.

In either situation the property valuation back of each student is more than sufficient to meet this criterion.

Microfilm $2.40; Xerox $8.40. 184 pages.

AN APPRAISAL OF STATE EDUCATIONAL ADMINISTRATIVE AND SUPERVISORY FUNCTIONS IN GEORGIA

(L. C. Card No. Mic 59-1123)

John Andrew Wimpey, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Dr. Arville Wheeler

The purpose of this study was to determine and analyze the proper role of the Georgia State Department of Education as a guide for the educational administrative and supervisory functions of the state. To do this, the present functions of the Georgia State Department of Education, plus other suggestive functions, were evaluated. They were appraised in terms of desirable or undesirable state service by ninety-six school officials who were stratified into the following groups: twenty system superintendents, seven state supervisors, thirty-two principals of large high schools, twenty-three principals of small high schools, and fourteen principals of medium size high schools. The appraisal data of the state's role was gathered through personal interviews with the selected school officials.

Summary of Findings

Although the Georgia Constitution of 1777 provided that "schools shall be erected in each county and supported at the general expense," it was not until after the Civil War that the free public schools were established. Whereas school property in 1871 amounted to practically nothing, its value by 1934 was $55,013,765. Moreover, by 1952 the value of buildings and grounds alone was more than $183,000,000, and the value of libraries and equipment more than $212,000,000. An amendment to the Georgia Constitution passed in 1904 permitted local taxation for common schools, and an amendment passed in 1910 made it possible for counties to establish high schools.

The public schools are supervised by an appointive ten-member state board of education through an elected state superintendent of schools. The superintendent handles state school supervision through the division of field services which maintains state supervisors as field representatives of the Georgia State Department of Education in the various educational areas of the state. State department functions are largely regulatory and consultative.

Achievements of a general nature concerned the following service areas: audio-visual materials, exceptional children and youth, finance and business administration, instruction, public relations, pupil transportation, research and statistics, school attendance and census, school law, school library, school plant, school lunch, surplus property, teacher certification, teacher education, textbooks, vocational rehabilitation, and state and local cooperation. The achievements of a general nature revealed attempted services of the Georgia State Department of Education which received approval of the school officials interviewed. Although these achievements of a general nature have gradually gained acceptance by the local school officials, there was inadequate personnel in the state department to adequately handle all these services.

Functions of a general nature desired by the local school officials, but not accepted by the state department of education, concerned the following: adult education, correspondence schools, guidance, curriculum development, local school

unit reorganization, teacher placement, local school records and reports, state scholarships, and vocational guidance.

The study showed the variation among states in staff time devoted to identical service areas. Extreme variations implied serious inadequacy in the total staff service distribution of the state department of education. The division of vocational rehabilitation in Georgia received 43.13 per cent of the total staff time which exceeds the average of other states by 20 per cent.

A community recreation program was not desired by either the local officials or the state department of education. Also, a lack of unity of purpose was revealed as some state supervisors preferred autonomous offices independent of the department while about half of the supervisors accepted the present centralized organization. Such findings indicate that a continuous reappraisal of the services in accordance with the needs of the state is essential for the development of harmony and balance in the Georgia State Department of Education.

Microfilm $4.05; Xerox $13.60. 313 pages.

GROUP PROCESSES IN PUBLIC SCHOOL ADMINISTRATION IN SAN DIEGO COUNTY, CALIFORNIA

(L. C. Card No. Mic 59-1125)

Harold La Ron Woods, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Erick Lindman

The purpose of the present study were to determine the extent of the use of staff involvement in the administrative function of the public schools of San Diego County and the nature of the purposes held for such involvement. The interview technique was the method used for collecting the data. The study involved teachers, administrators, and community adults as they operated in problem solving situations. The writer was a curriculum coordinator working in the various schools of the county. He, or some other coordinator from the county office, served as consultant to all groups reported in the study.

The Findings

One thousand three hundred and thirty-eight, or 75 per cent of the sample responded positively to the twenty-two items which could be recorded by check marks on the interview guide. This was in comparison to 265 persons or 15 per cent who expressed doubt, and 180 persons or 10 per cent who responded negatively.

Many problems in public school administration should be solved by group discussion. The areas of budgeting, salaries, evaluation, curriculum, teacher selection, and equipment and supply orders are examples of these. Insurance, legal rulings, building maintenance, and acquiring new school sites are the chief problem areas which do not require group action.

Certain standing committees are desirable. An administrative council, composed of teachers and administrators, is an appropriate group to function as a standing steering committee.

Ways in which members become involved in discussion groups are automatically, voluntarily, and by representation. All people to be affected by a decision should have the opportunity to influence the nature of it. The school staff should expect to be involved in group decision-making.

Communication, getting ideas from all personnel, best solutions to problems, dividing the work load, encouraging individuals to work on problems of concern to them, and promoting in-service training and professional growth are the chief purposes for involving personnel in the administrative function. Leadership should shift from person to person as the individual feels competent to contribute. The group, itself, should select its own problem for solution. Observers of group process may well be used to good advantage. Minutes or records should be kept of each discussion group. Consultants from outside the district should be used as needed.

The influence of group involvement has definite carry-over into classroom operation. Group processes have been used long enough to prove worth-while. Inspirational speakers may be desirable in beginning the year's work.

The evidence of such positive responses clearly indicates that group processes have an ever increasingly important place in the democratic function of public school administration. Such responses would clearly indicate, too, the desire for and the necessity of involving all people concerned in the administrative function.

Microfilm $2.15; Xerox $7.60. 161 pages.

EDUCATION, ADULT

THE PRODUCTION OF A COMMUNITY DEVELOPMENT FILM ("RACINE LAKESHORE DEVELOPMENT") AND ITS EFFECT ON OPINIONS OF LOCAL VIEWERS

(L. C. Card No. Mic 59-1403)

James Lee Page, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Walter A. Wittich

The purpose of this study was to plan, produce the documentary 16mm film "Racine Lakeshore Development," and determine its influence on the opinions of local viewers.

The film, produced by the Racine Adult Education Council, depicted the past, present, and possible future of Racine's lakeshore.

Racine adults (396) from 11 different community organizations and high school social studies students (92) participated. The study included (a) the total sample (488), (b) the male (163) and female (315) groups, and (c) three age groups.

Identical questionnaires were used before and after seeing the film. Section one of the questionnaires asked about desirable and undesirable places in Racine. Section two requested an evaluation of fifteen community development factors. Section three was devoted to questions about Racine lakeshore development.

The questionnaires were filled out immediately before

and after the film showings. The participants were not selected by random sampling. Tests of significance were conducted with Chi Square.

Some of the pertinent findings were as follows:

1. Significant changes of opinion for the total sample were found in part of all sections of the questionnaire. These changes may largely be attributed to viewing the "Racine Lakeshore Development" film.
2. In all but two cases where participants were asked to respond after the film viewing, the "Don't Know" or "No Response" answers decreased and the total response shifts went to a "Yes," "No," or other definite answer. The consistency of this trend suggested that the film influenced the viewer's opinion significantly in the majority of cases.
3. Emphasis on a particular local community development area in the film tended to lessen the importance of other local community areas in the opinions of the film viewers.
4. Significant changes of opinion for the male and female groups in this study were found in part or in all sections of the questionnaire. In most cases a larger percentage of females than males changed their opinions after viewing the film.
5. All age groups showed significant changes of opinion in part or in all sections of the questionnaire of which part might be attributed to the viewing of the film. The findings suggest that some subjects have a special interest for a specific age group and the older the age group the less susceptible it is to significant opinion changes.

In conclusion, the purpose of this study was to plan produce the documentary film "Racine Lakeshore Development," and determine its influence on the opinions of local citizens. Several analyses were made for the total group, sexes, and three age groups. In the majority of cases significant opinion changes were found in one or more of the areas in the questionnaire for all groups studied. The findings are only applicable to the subjects and criteria used.

Further research should be conducted to (a) compare the effectiveness of the locally produced community development film with other media, (b) find the retention of opinion changes as a result of viewing a locally produced community development film, (c) compare the changes of opinion of various occupational, age, sex and length of residence groups viewing the film, and (d) to search for empirical evidence to show community action as a result of viewing a related community development film.

Microfilm $3.20; Xerox $11.00. 246 pages.

A MANUAL FOR THE ORGANIZATION, SUPERVISION AND ADMINISTRATION OF INFORMAL ADULT EDUCATION CENTERS SPONSORED BY THE BOARD OF EDUCATION OF THE CITY OF NEW YORK

(L. C. Card No. Mic 59-1036)

Sidney Silverman, Ed.D.
New York University, 1958

Chairman: Professor John Carr Duff

During the last decade, adult education has experienced a significant growth in the City of New York as evidenced by the increase in enrollment from 1200 students in one full-time center to 200,000 students in six full-time and many part-time centers. As the program developed, memoranda were issued and verbal directives were given, but the principals still had to rely upon their own experiences and ingenuity to solve many of the problems associated with the organization, supervision and administration of these schools. As a result, they became involved with the personal discovery of procedures and techniques which should have been available to them as a normal consequence of assuming the position of principal of the adult school. In order to help correct this situation, this study was undertaken.

The investigation was divided into five sub-problems, the first four of which were concerned with obtaining data about the organization, supervision and administration of adult education, and with ascertaining the principles which should serve as the underlying philosophy for adult education practices. The fifth sub-problem dealt with the development of the manual itself.

The scope and contents of the topics contained in manuals published by other large cities with a population of 500,000 or more were determined. The contents were tabulated according to principles of adult education, organization procedures, administration techniques and special community programs.

A questionnaire was prepared to determine the topics teachers, principals and leaders of adult education thought the manual should contain. A comparison of their responses was made in order to determine the topics about which there was agreement for inclusion in the manual. Their suggestions were also compared with the content of the publications produced by the large cities.

As a result of these comparisons, a number of topics were considered important enough for treatment in the manual. Under the heading of organization were found such topics as the organization, of a lay advisory council, the role of the Director of the Bureau of Community Education, the role of the principal of the adult center, the role of the teacher of adults, the methods of determining needs and interests of adults, the preparation of a schedule of classes, the financing of the adult education program and the adult student council.

Under supervision it was deemed necessary to consider the selection of the teaching staff, the in-service training of the teaching staff, the psychology of adult learning and the methods of teaching adults.

Under administration it was suggested that the manual deal with the administrative office, registration, budget and finance, salary and payroll, bookkeeping, supplies and equipment, records reports and forms, special administrative concerns, public relations and program evaluation.

In addition to these topics, the study showed that there were at least thirty-six principles which should serve as the guideposts for adult education practices.

Microfilm $3.40; Xerox $11.60. 264 pages.

AN ANALYSIS OF THE AIMS AND OBJECTIVES OF PRIVATE CAMPING

(L. C. Card No. Mic 59-1038)

Moe C. Spahn, Ph.D.
New York University, 1958

Chairman: Professor Milton A. Gabrielsen

The purpose of this study was to analyze the camping aims and objectives of selected groups of campers, parents, camp

directors and educators with a view to formulating guiding principles for the operation of private children camps.

A summary of the procedure which was followed in this study is:

1. A review of the literature was made to establish the current goals of education and the aims and objectives subscribed to by various national organizations promoting camping, camping groups and individual authorities.

2. The camping aims and objectives identified from the literature were compiled into a list of forty statements which reflected the basic concepts of camping.

3. The forty statements of aims and objectives were submitted by use of an opinionnaire to a random sampling of parents, campers, camp directors and educators. Each participant was asked to make a judgment with respect to the relative value of each objective in light of his personal viewpoint.

4. A statistical analysis was made of the expressed viewpoints of the four groups. A mean rank for each objective was obtained for each of the four groups. This was followed by a rank difference correlation in order to demonstrate the degree of relationship which existed between the four groups.

5. The investigator derived principles from the list of forty aims and objectives. In order to indicate the relative importance of these principles, the mean ranking of each group on each of the objectives from which the principle was derived was recorded.

The major conclusions which may be drawn from the study are:

1. Of the four categories of aims and objectives, the social category was considered to be the most important by all groups.

2. A striking contrast between the groups was revealed by the high ranking given the emotional aim by the camper group in comparison with the relatively low ranking given this category of objectives by the adult groups.

3. The educators and camp directors rated the group of educational aims higher than the parent and camper groups. The educator group rated the physical and health aims the lowest of all the camping aims and objectives, while the parents and campers rated the same group of objectives relatively high.

4. The lowest correlation obtained was between camp directors and campers; however, this correlation was not significant by chance from a zero correlation.

5. The attitude of campers towards the objectives of camping differ from those of the three groups studied.

6. The data indicated that camp directors and parents are closer together in their judgments on the relative importance of camping aims and objectives than the other groups.

7. In relationship to the three adult groups the camper opinions were most closely linked to those of the educators.

8. The parent, educator, and camp director groups tended to agree with each other on the camp objectives to a greater extent than they did with the camper group.

9. There was general agreement between the four groups that development of character should be a very important objective of any camp program. Each of the four groups ranked character development in the first three of the forty objectives.

10. Social development was considered to be another very important objective of camping by the four groups with the camp director and educator groups ranking this objective first.

11. The ordinal sequence of importance assigned to each aim by the educator's group was very interesting. The fact that greater emphasis was given by the educators to the social aims than to the educational (learning) aims, which were rated second, is indicative of their views of camping as primarily a social experience and secondarily an educational experience.

12. It was significant that campers should rate as first the importance of planning activities around the cabin group, while the camp director's group considered this only moderately important.

13. The lack of importance that campers placed on appreciation for and knowledge about conservation of our natural resources would indicate the need for greater emphasis of this subject by both camps and schools.

14. The study indicates that private camp directors should pay more attention to the needs and desires of children, and give the campers an opportunity to assist in the planning.

15. There is a great need for development of more definite standards for camping and a reliable, objective procedure for evaluating camps in terms of these standards.

Microfilm $2.25; Xerox $8.00. 172 pages.

EDUCATION, HISTORY

A TEXT IN CONTEMPORARY WORLD PROBLEMS WRITTEN IN ACCORDANCE WITH SELECTED READABILITY AND INTEREST FORMULAS

(L. C. Card No. Mic 59-1055)

Milton Finkelstein, Ed.D.
New York University, 1958

Student comprehension of text materials is basic to their effective use. Numerous studies have demonstrated that social studies textbooks are frequently difficult reading for their intended audiences. They are often heavily loaded with difficult abstractions and concepts whose meaning is assumed rather than clarified by text authors. Writing styles tend to be uninteresting, making more difficult the use of a text by students whose reading ability and informational backgrounds vary widely.

The appearance of educationally accepted formulas to measure readability and interest levels makes possible the creation of text materials in the social studies which are so constructed as to be readable and interesting to all of the members of a given class. The conclusions of recent studies of desirable concepts and aims to be developed in social studies teaching make available sets of specific goals (formulated by authoritative educational groups) for which implementing text materials are needed.

The document is divided into two parts, each intended to meet one of the needs indicated above. It presents a methodology for the creation of readable and interesting social studies text materials written to implement a selected set of goals. It also presents a textbook illustrative of the techniques proposed. This textbook, related to the world history course commonly taught in the 10th and 11th grades, deals with four selected contemporary world problems, treating each in depth and relating each to the broad

concepts detailed in the first part of the document as among those essential to the development of democratic citizenry. These problems – government, imperialism, international cooperation, and industrial change – are selected as significant in the contemporary world and as proper themes about which the selected aims may be achieved.

A series of tables demonstrate that the text is consistently within the selected limits of readability and interest. The testing of each page of the text as well as a sampling of the entire text reveal that the materials are within the reading range described by Flesch (Flesch Readability Formula) and Dale and Chall (Dale-Chall Formula for Predicting Readability) as VII-VIII, and that the text is consistently within or above the range "Interesting" as indicated by the Flesch Interest Formula. Other tables demonstrate the extent to which the text materials are related to the selected concepts and aims emphasized in the text.

The document is intended to enrich the teaching of social studies in secondary schools in four ways. (1) As a first attempt to write a text utilizing the selected measures of readability and interest, it indicates a methodology for the construction of text materials in social studies and other content areas. (2) While the contents of the text are of most direct interest to teachers of world history, they are also of utility as supplementary material for teachers of other areas of the social studies. (3) The text materials are related to the implementation of a recognized set of educational goals related in turn to the development of an alert and informed democratic citizenry. (4) Finally, the document presents and applies a theory of textbook construction which is primarily concerned with the formation of concepts, recognizing that concept formation is the prime task of the social studies.

Microfilm $7.70; Xerox $26.20. 605 pages.

A HISTORY OF THE ORIGIN AND DEVELOPMENT OF INSTRUCTION IN READING IMPROVEMENT AT THE COLLEGE LEVEL

(L. C. Card No. Mic 59-1016)

Paul D. Leedy, Ph.D.
New York University, 1958

Chairman: Professor Alonzo F. Myers

The purpose of this study was to examine the origins of reading improvement instruction in the American college and university and to investigate the influence which have contributed to such development.

To accomplish this purpose, it was necessary, first of all, to appreciate the position of reading as a discrete academic activity in the higher education of the past. Reading implies the use of books, so that the status of the college library as well as the prevailing attitudes with reference to the place of books in the educative process and attitudes generally with reference to reading were pertinent to this study.

A corollary influence, which developed late in the nineteenth century, was the emphasis which the early psychology gave to the study and investigation of reading. This emphasis arose out of experimentation with respect to perception and investigations of the movements of the eyes while reading. This experimentation originated in Europe but soon spread to America, where it rapidly developed. College students were used widely as subjects for these psychological experiments. From 1915 to the present increasing attention has been given in the area of higher education to the improvement of the reading skills of the college student. The efforts in this respect are largely to be found in the professional literature of the day. The contemporary effort at reading improvement was studied through the means of a questionnaire sent to a selected list of colleges in thirty-three states of the Union. Ninety-two colleges and universities having reading programs for their students cooperated by furnishing information about the organization and functioning of those programs.

From a methodological standpoint, the historical method of research was employed in developing this study. Historical research predicates the necessity of working from primary sources, so far as possible, and in the necessity of gathering and organizing the data accurately. To insure the integrity of these several matters, most of the data was microfilmed from the original sources. The relationships and interrelationships of the data were sought, and all data were carefully tested by certain specified criteria.

This study would suggest certain conclusions:

1. Reading improvement in the contemporary college has resulted from a slow but orderly evolution in the recognition of the importance of the place of reading in higher education.
2. The reading improvement is now an established feature in many institutions of higher learning in America.
3. The reading improvement program arose as the answer to the problem of reading and study inefficiency which was recognized alike by the college as well as by the student himself.
4. The reading improvement program is at the present time in a period of flexibility with respect to methodology, materials, and procedures.
5. Much of the work of the reading improvement program is now under the aegis of the student services.
6. Faculties need to be educated as to the real function of the reading program and with respect to their own role with respect to reading instruction.
7. Many who are engaged in reading improvement instruction envision a far greater mission for the reading program than it has thus far had.

Microfilm $6.45; Xerox $22.40. 508 pages.

THE CALCULUS PROGRAM IN THE TWENTIETH CENTURY AMERICAN COLLEGE

(L. C. Card No. Mic 59-1110)

Merle Mitchell, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: F. Lynwood Wren

The purpose of this study were to survey the calculus program in the twentieth century American college in order to determine factors active in shaping the program, to discover trends in calculus curriculum patterns in several kinds of colleges, to trace changes in calculus texts, and to use these findings to predict future developments.

A brief history of the calculus program prior to 1900 was given first to supply the background for the rest of the

study. The method used in discovering the forces promoting change was a consideration of the recommendations of several committees on the mathematics curriculum, of surveys outlining the status of the program at various times, and of opinions of numerous mathematicians, educators, and engineers. Catalogs of liberal arts colleges, technological schools, teachers training institutions, and junior colleges furnished the basis for the study of curricular changes and for the comparison of developments in calculus courses at the four types of schools. Seventy calculus texts published throughout the 1900-1956 period were analyzed for content, organization, and treatment of subject matter. Finally, the several editions of five very successful texts were studied in detail to determine the changes occurring from one edition to the next.

Some of the major findings of the study were as follows: (1) The unification of the branches of calculus and of calculus with other subjects is perhaps the most outstanding development in the twentieth century program. (2) The trend in the placement of calculus has been steadily downward until at present it is frequently taught at the freshman level in the larger colleges. (3) Changes in the curriculum and in texts to allow better correlation of calculus with other subjects were much in evidence at the beginning of the century. Problems of the correlation of calculus with other subjects have been partially solved by the use of integrated texts and by the scheduling of calculus earlier in the curriculum. (4) The presentation of elementary calculus has become more rigorous during the fifty-year period by more attention to definition and by a growing tendency to indicate departures from strict rigor in proofs. (5) The content of the first course in calculus has increased in the number of topics treated, in the amount of explanation, and in the number of problems included for solution. (6) The introductory course involving parts of calculus has brought the subject into contact with such modern mathematical concepts as sets, logic, and postulational systems. (7) The dates 1910 and 1940 seem to be the points at which the calculus program took new directions.

Predictions for the program of the future included the replacement of elementary texts on calculus alone by texts combining calculus with other mathematical subjects, the definition of the definite integral as a limit of a summation rather than as the change in value of an indefinite integral, the widespread use of Duhamel's and Bliss's principle in the application of the Fundamental Theorem of Integral Calculus, and the individualization of texts involving elementary calculus. Microfilm $5.55; Xerox $19.40. 435 pages.

AN EXAMINATION OF THE PERPETUATION OF SOUTHERN UNITED STATES INSTITUTIONS IN BRITISH HONDURAS BY A COLONY OF EX-CONFEDERATES

(L. C. Card No. Mic 59-1062)

Daniel Ginter Rosenberger, Ed.D.
New York University, 1958

Chairman: Professor Durward Pruden

This study is an attempt to trace the history of a colony of ex-Confererates, mostly Louisiana sugar planters, who settled in British Honduras after the Civil War, from the time of the inception of the colony, about 1867 to 1929, when the colony was definitely disintegrating. In order to have a basis for comparison, a parallel study has been made of the sugar planters who remained in Louisiana covering the same period. In order to have a comprehensive picture of each of these groups, their culture is organized under five different heads: political, economic, social, educational, and religious.

The first chapter is the outline of the problem. The next two chapters are introductory history -- chapter two tracing the history of British Honduras to 1864, and the third chapter tracing the history of Louisiana to the Civil War, but with a special emphasis on the production of sugar in that state. Subsequent chapters explore the problems of the two groups.

As a result of the economic and social policies of the Reconstruction Governments in the South, a number of Southerners decided to emigrate to other lands. As Young, Toledo & Company of British Honduras offered to sell their cut-over timber lands to emigrants on very favorable terms, one group of these Southerners purchased land from the Company and located near the small town of Punta Gorda in Southern British Honduras, naming their community Toledo Settlement. While about 200 emigrants originally started to work clearing the land there, the rainy season, malaria, Asiatic cholera, and unsuitable crops, all helped to cause most of them to return to the United States. Levi Pearce, a Methodist minister from Mississippi then returned to the United States and persuaded other Southerners to come to British Honduras. About seven new families joined Levi Pearce and the scanty remnants of the original group at Toledo Settlement and the emigrants began to raise sugar cane and manufacture sugar in a small way, using inefficient, open pay evaporation.

The colony grew and enjoyed modest prosperity up to the year 1890, when it had 600 acres of land in sugar cane, and had cleared about four square miles. After 1890 the colony began to decline. The cheap bounty-supported sugar from Europe had destroyed the market in England for colonial sugar. The American settlers continued to produce for the local market, but World War I regulations kept the price of sugar low in the colony, and at the end of the war, Guatemala began to send cheap sugar into British Honduras. The colonists tried to get tariff relief from this situation, but were unsuccessful. As a result, in 1925 they gradually began to return home to the United States.

In contrast with the American settlers in British Hunduras, the Louisiana sugar planters attempted to re-establish life as they had known it on the plantations before the Civil War. They were faced, however, with new conditions and as life on the plantations became less attractive and profits declined, the old planters or their children after their parent's death, frequently sold the land to Northern men, Southern men with capital, or large corporations. In this way the pre-Civil War caste system broke down, and personal ownership of land gradually gave way to corporate control.

A comparison of the two groups shows that the Americans who emigrated to British Honduras retained their old Southern customs longer, but that a lack of capital forced them to abandon sugar as a crop and return to the United States. The Louisiana planters on the other hand, had capital come into the region, but with it came corporate control and modern big business. The social solidarity of this group was thus broken, and the descendants of the Louisiana planters scattered. Microfilm $4.80; Xerox $16.00. 375 pages.

EDUCATION, PHYSICAL

THE EFFECT OF MENTAL PRACTICE ON THE DEVELOPMENT OF A CERTAIN MOTOR SKILL

(L. C. Card No. Mic 59-1356)

L. Verdelle Clark, Ed.D.
Wayne State University, 1958

Adviser: Wilhelm Reitz

Purpose

To compare the effect of mental practice with that of physical practice in the development of a motor skill, the Pacific Coast one-hand foul shot, in a search for findings that may be utilized by coaches and physical educators to improve their instructional skill.

Methodology

Thirty-six subjects from each of two high schools in Detroit, and two suburban to Detroit, for a total of 144, were equated into two groups of near equal ability for the factors of (a) Arm Strength, and (b) Intelligence, in preparation for an experimental design, taking into consideration the following additional factors: (c) Schools, (d) Classes, or degree of experience as categorized by the terms Varsity, Junior Varsity, and Novice basketball players, and (e) Groups, as indicated by the terms Mental Practice and Physical Practice.

All subjects were trained in the basket-shooting technique commonly referred to as the Pacific Coast one-hand foul shot on the first day of the experiment. Initial scores were established for all subjects after 25 practice shots on the basis of 25 foul shot attempts. On the second day of the experiment, the mental practice subjects were given instructions on the technique to be used by that group. They were then directed to "mentally practice" five warm-up shots, and 25 shots for score for the remaining four days of that school week, and five days each of two additional school weeks for a total of 14 days. Each subject was instructed to "mentally practice" shooting imaginary foul shots at about the same rate as if actually shooting baskets. Testing for the Final Score was held on the fourth consecutive Monday. The physical practice group subjects were instructed to take five warm-up shots and 25 shots for score to the best of their ability for a number of practice days equal to that of the mental practice group subjects. Testing for Final Score was on the fourth consecutive Monday for this group also.

Analysis of Covariance was the method selected for the treatment of data. This operation made it possible to increase the precision of the experiment by the elimination of causes of variation not controlled by the experimental design.

Introspective analysis of the experimental procedure by the subjects was also employed.

In addition, simple mathematical computations were made to determine the answers to several practical questions, and for purposes of graphic illustration.

Conclusions

1. Both the Physical and Mental Practice groups showed highly significant gains, with t-values of 10.5 and 7.7 respectively.

2. Comparison of physical practice with mental practice shows that physical practice resulted in average gains of 16% for the Varsity groups, 24% for the Junior Varsity groups, and 44% for the Novice groups, as compared to those of the Mental Practice groups which had average gains of 15%, 23%, and 26% for the equivalent categories. Thus mental practice was almost as effective as physical practice for the Varsity and Junior Varsity groups, and not as effective for the Novice groups.

3. Covariance Analysis disclosed that there was a significant difference between the means of the adjusted final scores of Arm Strength, School, Class, and Group categories. The latter three were significant at the 1% level, while the factor of Arm Strength was significant at the 5% level.

4. The factor of intelligence, as measured by the Short Form of the California Mental Maturity Test, was found to exert no influence.

5. The introductory training period, the purpose of which was to train the subjects in better use of perceptual ability for the development of motor skill, was highly effective.

6. Introspective analysis disclosed that the subjects apparently represented a wide range of ability to visualize, or picture in the mind's eye, the shooting movements of the basketball skill involved.

7. Mental practice caused certain subjects to experience unusual hallucinations of the shooting technique.

8. Mental practice resulted in a growth of the ability to visualize, or picture in the mind's eye, the shooting technique for a majority of the subjects.

9. A majority of the mental practice subjects introspectively experienced a progressive increase in confidence in their ability to shoot foul shots.

10. Mental practice resulted in a majority of the subjects developing an acute sense of instantly recognizing mistakes in technique by the time of the actual testing for Final Score.

11. There may well be some optimum combination of physical and mental practice sessions that is potentially superior to methods generally employed today to develop motor skill. Microfilm $3.20; Xerox $11.00. 247 pages.

THE ESTABLISHMENT OF PRINCIPLES OF HUMAN RELATIONS THAT MAY BE USED IN THE TRANSITION OF ALL-WHITE OR ALL-NEGRO CAMPS TO INTERRACIAL CAMPS

(L. C. Card No. Mic 59-1045)

Thomas A. Hart, Ed.D.
New York University, 1958

Chairman: Professor Raymond A. Weiss

The Problem

The problem of the study was to derive and validate principles of human relations that may be used in the transition of all-white or all-Negro camps to interracial camps and to determine the workability of each principle by applying it to a selected group of interracial camps. There were three phases of the problem:

1. The derivation of the principles from the literature
2. The validation of the principles through the use of the literature and a jury
3. The testing of the workability of the principles by applying them to a selected group of interracial camps.

Procedures

The data needed for the study were obtained in five steps:

1. The literature related to human relations and camping was identified. A list was compiled of all such materials.
2. Statements of human relations and camping were collected from the material found in step one and analyzed to find out if they could be used in this study.
3. The statements collected in step two were organized into seven headings according to content.
4. The statements were formulated into principles of human relations that may be used in the transition of all-white or all-Negro camps to interracial camps. Each statement was validated by documentary analysis.
5. The principles were validated further by the use of a jury of experts in the area of interracial camping.

The Findings

As a result of the study the findings of the investigator are presented:

1. A great deal has been written on human relations in the United States; however, very little has been published on interracial camps.
2. Twenty-three principles of human relations that may be used in the transition of all-white or all-Negro camps to interracial camps were formulated and validated by the use of the literature and a jury.
3. These principles were formulated into seven major groups, which are the following:
   a. Principles which relate to the philosophy of interracial camps
   b. Principles which relate to the objectives for interracial camps
   c. Principles which relate to the organization and administration of interracial camps
   d. Principles which relate to the leadership phase of interracial camps
   e. Principles which relate to the selection of campers and counselors for interracial camps
   f. Principles which relate to the program of interracial camps
   g. Principles which relate to the public relations phase of interracial camps
4. The five directors of interracial camps who tested the workability of the twenty-three principles of human relations for interracial camps found the principles to apply "all or almost all times" or "part of the time" to their camping situations. Nineteen of the principles were rated in the first category of importance (should apply "all or almost all times"). Only two principles were rated in the second category of importance (should apply "part of the time").

Conclusions

The findings of the research impel the investigator to draw the following conclusions:

1. According to the evidence revealed, a resident boys' or girls' camp has many desirable characteristics that may aid in the improvement of human relations.
2. The principles of human relations that may be used in the transition of all-white or all-Negro camps to integrated camps presented in this dissertation are valid and applicable, according to the literature involved and in the judgment of five outstanding directors of interracial camps.

Microfilm $3.55; Xerox $12.00. 275 pages.

THE PHILOSOPHIC RELATIONSHIP BETWEEN PHYSICAL EDUCATION AND ATHLETICS

(L. C. Card No. Mic 59-1059)

Orvis C. Krug, Ed.D.
New York University, 1958

Chairman: Professor Raymond A. Weiss

Based upon the assumption that educational purposes in the United States should be grounded in and consistent with the democratic ideal, this study establishes a non-theistic basis for morality from which one may rationally and consistently conduct his educational practices.

The purpose of this investigation was to determine from a particular philosophic perspective the relationships of college physical education and intercollegiate athletics, and to make recommendations concerning these relationships with regard to purposes and patterns of function.

The study was undertaken from the perspective of the democratic ideal as developed by John Dewey, Boyd H. Bode, William Heard Kilpatrick, Horace Meyer Kallen, Sidney Hook, and John L. Childs. Analysis of this ideal suggests that it is an outgrowth of the biological and social understanding of man resulting from modern science and the historical experience of democracies, rather than being derived from theological or metaphysical considerations.

This non-theistic analysis is made out of no antipathy for theism; it is made rather as a basis upon which minimum common agreements may be reached. It is an effort to avoid controversies inevitable in a theistic approach.

This was a philosophic study. The focus was educational value; what ought to be. What ought to be done in physical education and athletics in light of the principles (of this concept) of the democratic ideal and the purposes of higher education? How can physical education and athletics best serve the purposes of higher education?

Since this investigation dealt with educational value,

the method was philosophical. Validation was by documentary analysis and logic.

The democratic ideal in this study was not to be confused with American Democracy. American Democracy was the fact; the democratic ideal was the aspiration.

This democratic ideal was shown to be a profoundly moral way of life. American Democracy, having not yet achieved the ideal in all its aspects, was indicated as being, perhaps, a somewhat less profoundly moral way of life. This difference in degree of morality was the basis upon which the major recommendations were made.

Conclusions

(1) Athletics in higher education ought to be an integral part of physical education, a terminal aspect of the broad physical education program.

(2) The indicated pattern of function is athletics in a department of physical education with one department head, and with physical education responsible for the conduct of athletics.

(3) Physical education and athletics in higher education ought to be so conceived as to be compatible.

(4) Physical education and athletics in higher education ought to be conducted as educational activities.

(5) Physical education ought to contribute to the total development of each student according to its potential capacities to do so, and ought to do this by use of all those educational activities which are included in one's definition of physical education.

(6) Both physical education and athletics ought to be judged on the basis of their educational value.

(7) Athletics in educational institutions should be conducted primarily for their educational and moral values. Preoccupation with their pecuniary aspects defeats these values.

(8) Colleges and universities should divorce the entertainment or money-making aspects of athletics from the educational aspects. This means that institutions of higher education should stop making money via athletic spectacles.

(9) Educators should be expected to both feel and deduce their responsibility to act courageously against any tendency toward compromise of the moral educational principles from which higher education devolves.

(10) Leaders in higher education ought to set an example of incorruptible morality.

(11) Higher education should not only mirror American Democracy, but should also exemplify those democratic ideals which are so easily overlooked.

Microfilm $3.35; Xerox $11.40. 260 pages.

EVALUATION OF SELECTED MEASURES AS FACTORS IN ATHLETIC PERFORMANCE AND SPORTS PARTICIPATION AND PREFERENCE

(L. C. Card No. Mic 59-1107)

Gale Ellington Mikles, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Solon Sudduth

The purpose of this study was to evaluate certain selected measures as general factors in athletic performance, and sports participation, and preference. The measures evaluated were chronological age, height, weight, general motor ability, intelligence quotient, and personality.

The criterion for athletic performance was based upon ratings assigned by veteran coaches as their estimate of the performance level attained by each athlete. This rating in turn was based upon the coaches' knowledge and insight concerning the achievement and ability of the boy.

The population tested was composed of 134 high school senior athletes from five schools of the 6A League in the state of Michigan. These boys were from sixteen to nineteen years of age, had been athletic squad members for at least two years, and represented participation in nine different sports. Testing was done in the fall and spring of 1956-57.

The obtained data were analyzed statistically. The correlation technique was used to determine the relation of each measure to the other measures and to the criterion. Measures that correlated significantly with the criterion were entered into a multiple correlation matrix, and the total common variance between the measures and the criterion was computed. A multiple regression equation was calculated to test the significance of each of the four measures as predicators of the criterion.

The coaches' rating established four performance groups of varying achievement and ability. Student t's were computed to ascertain the measures that discriminated between groups.

The sample was broken up into the nine different sports groups. Mean scores on each measure were calculated for each sports group and for the total athlete population. Student t's were computed between the mean scores of the different sports groups and the mean score of the total population on each of the six measures. This was done in an effort to determine the measures that were factors in participation in the various sports.

An item analysis of the personality inventory was run in an effort to obtain insight into the personality characteristics of the participants in the various sports and to determine factors in sports preference.

Summary of Findings and Conclusions

All results were tested at the .05 level of significance.

Athletic Performance

The measures of age, personality, general motor ability, and intelligence correlated significantly with the rating of athletic performance. Correlations of height and weight with the criterion were not significant. A multiple correlation of the four significant measures with the criterion yielded a significant multiple correlation of .712. A multiple regression equation revealed that all four factors contributed significantly to an estimate of the criterion.

Discrimination of the Measures

The measures of age, personality, and general motor ability demonstrated ability to discriminate between four groups of athletes representing different levels of performance. Measures of age, weight, general motor ability, and intelligence differentiated between various sports groups and were established as factors in sports participation.

An item analysis of the personality inventory revealed certain personality characteristics that differentiated between participants competing in the various sports. Personality was established as a factor in sports preference.

Microfilm $2.00; Xerox $5.60. 112 pages.

A PHILOSOPHICAL INTERPRETATION OF THE EDUCATIONAL VIEWS HELD BY LEADERS IN AMERICAN PHYSICAL EDUCATION

(L. C. Card No. Mic 59-1047)

Richard B. Morland, Ph.D.
New York University, 1958

Chairman: Professor Leonard A. Larson

This investigation was concerned with interpreting the educational philosophies of seven leaders in American physical education who were influential in determining the direction of the movement during the period following World War I when this field was striving for educational status and recognition. The assumption was made that even though their writings have been confined to a highly specialized area, each of the leaders has a total view of education and it is possible to identify and classify his beliefs according to systematic schools of educational philosophy.

In order to determine the philosophic positions of the physical educators, it was necessary to show the relationship of their views to those held by exponents of the various positions in educational philosophy. The comparative approach to philosophy was adopted, and after reviewing several different classifications, four schools of thought -- progressivism, reconstructionism, essentialism, and perennialism -- were selected as the basis for interpretation.

A broad frame of reference, consisting of six general areas with twenty sub-areas, was constructed for the basis of the comparative analysis. These areas centered on specific aspects of the educational process and its theoretical foundations. Included were the general philosophic orientation, the nature and factors involved in learning, the curriculum and the role of the teacher, administration and administrative practices, school and community relations, and educational aims.

Quotations were gathered from the works of ninety-six different educators and philosophers who were chosen as exponents of the four positions in educational philosophy. The technique of generalization was employed to formulate a basic point of view toward each of the phases in the general frame of reference from the standpoint of these competing philosophies. Following the presentation of the four positions, a summary of their principal beliefs in capsular form was charted in a table of philosophical ideas for comparative purposes and to facilitate the interpretation to follow.

Using the same topical headings, quotations were collected from the writings of seven professional physical educators, and a synopsis of their beliefs in each of these areas, when expressed explicitly or inferentially, was set forth. These leaders were Thomas D. Wood, Clark W. Hetherington, Jesse Feiring Williams, Jay B. Nash, Charles H. McCloy, Mabel Lee, and Elmer D. Mitchell. Although each is a recipient of the Gulick Award and all are recognized for their signal contributions to the field, no claim was advanced that these persons are the most outstanding that the profession has produced. The effort was made to select individuals with varied backgrounds in their professional preparations as well as in their teaching careers.

By comparing the views expressed by the physical educators with the general position as determined from the expositions of the representatives of the four schools of educational philosophy, the physical educators were classified in accordance with the consistency with which they followed the line of thought in any one of the four schools. Upon this basis, Wood, Heterington, Williams, Nash, and Mitchell were determined to be progressivists, while McCloy and Lee were found to support essentialism. Although in several instances there were deviations from the basic point of view, in the overall perspective it was found that the physical educators supported the positions as indicated above. Additional research is needed to determine if the favorable ration to progressivism revealed in the writings of these seven physical educators would hold as well for the other leaders in the profession, and whether or not the philosophy of progressivism is the most representative of the practicing teachers in the field.

Microfilm $7.00; Xerox $24.20. 552 pages.

SELECTED MEASURES OF PHYSICAL FITNESS APPROPRIATE FOR ELEMENTARY SCHOOL CHILDREN

(L. C. Card No. Mic 59-1113)

Roy V. Pangle, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Solon B. Sudduth

The intent of the present study is to develop a battery of physical proficiency measures appropriate for both boys and girls ages six through twelve. In addition to being a measure of a recognized component of physical fitness, each item to be included in the battery was selected with respect to the following criteria: (1) capable of demonstrating significant and acceptable reliability, (2) designed to yield a continuous point score, and (3) consistent with the demands of administrative feasibility.

Accordingly, a survey of related literature was made to identify previously used measures of physical fitness. Those which could not meet the criteria mentioned above were disregarded, and the remaining ones constituted the basis for the statistical and factor analyses. Included in the completed Trial Test Battery were twenty-eight proficiency measures and five related indices.

These thirty-three variables were administered to sixty-two elementary school children. The subjects were thirty-two boys and thirty girls selected at random from physical education classes in four white elementary schools of Davidson County, Tennessee. Ages of the subjects ranged from six through twelve and there was a comparable distribution with respect to grade levels. All subjects responded to each variable and the resulting 2046 raw scores were obtained and recorded by the investigator.

Statistical treatment of the data included: (1) computing

the product moment correlations between all possible combinations of variables, (2) factor analyzing the obtained matrix of intercorrelations, and (3) making a series of twelve successive single stage orthogonal rotations.

Using the Thurstone method of centroid analysis with orthogonal rotations of the axes, the matrix of correlation coefficients was factor analyzed. This resulted in the extraction of six factors. Twelve single stage orthogonal rotations were made attempting to reduce the configuration of tests to simple structure. At this point, five of the six factors suggested meaningful interpretations and they were identified with some reservation as follows:

Factor I Strength and Speed
Factor II Body Build and Growth
Factor IV Hand-Eye Coordination
Factor V Pulse Rate Function
Factor VI Muscular Power

Having statistically identified the above mentioned factors or components, the problem became one of associating the variables with the factor which each had a substantial factor loading. Finally, the test or tests which best measured a given factor was retained, and the six together incorporated into the Peabody Test of Physical Fitness.

The six tests and the corresponding factors for which they are considered to be the most appropriate measures are listed as follows:

Factor I Shuttle Run and Volleyball Throw
Factor II Weight
Factor IV Ball Bounce
Factor V Maximum Pulse Increase
Factor VI Burpee

Several distinct advantages of this battery are noteworthy. The specific nature of most measures of physical fitness is not a limiting factor as five recognized components are being assessed in the same administration. A second advantage is the fact that only items yielding continuous point scores were given consideration throughout the study and, hence, retained in the final battery. Too, the administrative feasibility of these six items is such as to meet most practical and administrative demands frequently made. Finally, and of considerable importance in view of the outstanding need for such, a representative method of assessing the physical fitness of the elementary school age boy and girl has been scientifically constructed.

Microfilm $2.55; Xerox $8.80. 195 pages.

AN EVALUATION OF THE HEALTH AND PHYSICAL EDUCATION PROGRAMS FOR GIRLS IN THE PUBLIC SECONDARY SCHOOLS IN MISSOURI

(L. C. Card No. Mic 59-1124)

Harriet Woodside Wright, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Solon B. Sudduth

The purpose of this study was to evaluate the health and physical education programs for girls in selected secondary schools in Missouri. The Health and Physical Education Score Card, No. II, compiled by Wm. Ralph LaPorte, was used as the evaluative instrument. The data was collected by the visitation-interview method in one hundred schools selected by random sampling. Code numbers were used in recording the data for each school. Comparisons were made of the data and some of the measures used for these comparisons were the mean, the median, the range, the quartile scores, and the standard error of the difference of the means. Bar graphs were used to show relationships of different areas scored. The scores of this study were also shown in relationship to a national cooperative study being made of the health and physical education programs in the schools.

Findings of the Study

The health and physical education programs for girls were found to have a mean total score that is 35.9 per cent of the total possible score presented on the score card. Schools were grouped according to accreditation and non-accreditation by the North Central Association of Colleges and Secondary Schools and the highest quality of programs was found in the accredited schools. Schools receiving the AAA or AA classification by the State Department of Education were found to have better quality programs than the schools receiving the A classification. The selected schools were divided into the five geographic districts and the Central District had the highest scores, although only significantly higher than the Southwest District. The schools were grouped according to town size and school size and there was a tendency to have better quality programs in the larger town and school sizes.

Bar graphs were used to show relationships between different area scores of the schools. The highest scoring area was concerned with the organization and administration of class programs. The lowest scoring area was concerned with modified activities.

The one hundred items scored were ranked and presented in a table. The highest scoring item was concerned with qualifications of the health and physical education instructors. Some other items scoring the highest quarter of rank were concerned with standards which have been recommended by the State Department of Missouri. The items which have the lowest rank are concerned with lack of swimming facilities and modified-activities.

Recommendations were made concerning a course of study, the outdoor areas, the classification of pupils, the health examination, the way to hold the interest of the students who desire to become health and physical education instructors, and the recognition of excellence in health and physical education activities for girls.

Microfilm $2.20; Xerox $9.80. 165 pages.

EDUCATION, PSYCHOLOGY

AN INVESTIGATION OF THE RELATIONSHIPS BETWEEN READING ABILITY AND LEARNING OF NON-READING TASKS OF VARYING COMPLEXITY

(L. C. Card No. Mic 59-1249)

Bruce Edward Balow, Ph.D.
University of Minnesota, 1958

This study provides a comparison of certain characteristics of learning ability among equally intelligent groups of good and poor readers. Good reader performance is compared with that of poor readers on non-reading tasks requiring rote learning and on non-reading tasks admitting of generalization, or concept formation.

A 400 pupil population of suburban public school fifth graders was measured with the Stanford-Binet Intelligence Scale and the reading comprehension subtest of the Iowa Tests of Basic Skills. The 52 boys and 52 girls at each extreme selected from a regression equation of reading ability on mental age, produced a sample of 208 pupils equally divided by sex and reading category. Reading ability was grossly different between good and poor readers of each sex, while mean CA, MA, and IQ were not significantly different.

Each member of the sample was measured with the Raven Coloured Progressive Matrices Test, a non-reading test of ability to reason by analogy. Performance on two non-reading learning tasks was determined, from which five scores were obtained: rote error, generalizing error, rote trials to criterion, generalizing trials to criterion, and a pass-fail indication of whether the pupil could state the principle leading to solution of the generalizing task.

The general statement of the hypotheses tested is that there will be no significant differences in means when a good reading group is compared with an equally intelligent poor reading group on non-reading tasks of rote learning, of generalizing, and of ability to reason by analogy.

Main analysis of data was by analysis of variance in a split-plot factorial design, to determine the effects on learning task error score attributable to reading group, sex, learning method, learning task, order of presentation of the two tasks, and interactions. Chi-square and t-tests were employed for other comparisons.

On only one of the measures was there found a significant difference between good and poor reader groups. For the girls only, there was a significance difference between means on the Raven Matrices Test, favoring the good readers. Incidental to the investigation of possible differences between reading groups, it was found that among all sample subjects the generalizing method was significantly easier than was learning the same items by rote.

It is concluded that, among equally intelligent pupils, those who have become retarded readers show no deficiency in learning, by rote or by generalization, the non-reading tasks of this investigation in comparison with those who have become good readers. Further, material which has internal relationships amenable to discovery by the pupil is more easily learned than is material which can only be learned by rote.

Microfilm $2.45; Xerox $8.40. 185 pages.

A STUDY OF THE EFFECTIVENESS OF SOME METHODS OF COUNSELING IN HELPING UNDERACHIEVING HIGH SCHOOL STUDENTS

(L. C. Card No. Mic 59-472)

Feriha Handan Balkis Baymur, Ed.D.
University of Illinois, 1958

The problem and purpose of the study was to investigate the effectiveness of different methods of counseling underachieving high school students, especially for raising their level of school achievement.

Three forms of counseling and a group were used:

1. Individual counseling, predominantly client-centered, was provided for one group once a week for a period of twelve weeks.
2. Group counseling, also conducted in a client-centered fashion was provided for another group in nine sessions during the experimental period.
3. A third group received a "one-session motivational counseling" consisting of direct persuasive appeal for better use of ability.
4. The control group received no treatment, except that inherent in taking pre- and post-tests.

The subjects were chosen from the Junior class (enrollment 220 students) of Urbana High School, Urbana, Illinois. The disparity between the percentile rank of a student on an academic aptitude score and the percentile rank of his grade point average for the previous semester was taken as the measure of underachievement. Thirty-two students identified as underachievers were divided into the four groups, matched in regard to: (1) degree of underachievement, (2) potential scholastic capacity, (3) academic achievement, (4) chronological age, (5) socio-economic status and (6) sex. These groups were assigned at random to different treatments and labelled as follows:

Group I, individually counseled experimentals

Group II, group counseled experimentals

Group III, one-session group counseled experimentals or motivational controls

Group IV, non-counseled, non-motivated controls

The criteria and instruments for data collection involved:

1. A special Q-Sort Test on personal adjustment (pre- and post-testing differences).
2. The Brown-Holtzman Survey of Study Habits and Attitudes (pre- and post-testing differences).
3. School achievement improvement (grades before and after treatment).

The null hypotheses tested were as follows:

1. Subsequent to the experimental period no significant differences will be observed among all groups in regard to (a) improvement in personal adjustment, (b) improvement in study habits and attitudes, and (c) improvement in school achievement.
2. Subsequent to the experimental period there will be no statistically significant differences between the two counseled groups and the two non-counseled groups in respect to the foregoing criteria.

The main findings were:

1. Two-way analysis of variance was used to test the first null hypothesis, and it was accepted within the set level of significance (five percent). However, certain consistent changes were observed favoring Groups I and II over Groups III and IV in respect to each criterion mentioned above.

2. The t-test for matched subjects, employed to evaluate the second null hypothesis, showed:

a) Greater positive changes had taken place in the counseled groups than in the non-counseled groups in personal adjustment ($p < .05$).

b) The counseled groups raised their grade point average more than did the non-counseled groups ($p < .05$).

c) No significant improvement was observed in the field of study habits and attitudes ($p < .20$), although the score gain for the counseled groups was numerically larger than the score gain for the non-counseled groups.

The basic conclusions were that:

1. Individual counseling and group counseling both were more effective in regard to personal adjustment and school achievement than was motivational counseling or non-counseling.

2. None of the treatments gave significant changes in study habits and attitudes.

3. It is probably better to leave the underachieving students alone than to urge them to do better or lecture them on what to do, without providing them with adequate counseling, since the non-motivated controls did consistently a little better than the motivated controls on all evaluative measures. Microfilm $2.20; Xerox $7.80. 168 pages.

PEER GROUP PERCEPTION OF MENTALLY SUPERIOR CHILDREN IN GRADES ONE THROUGH FOUR

(L. C. Card No. Mic 59-479)

Herbert Frederick Boyd, Ph.D.
University of Illinois, 1958

The purpose of this study was to investigate the peer group perception of mentally superior children in terms of the characteristics which the children themselves verbalize as reasons for liking other children.

One public school was selected at each of five well-identified socio-economic levels, the children in one first, second, third, and fourth grade class in each school being used as subjects. In all twenty classes, 565 children were queried. Eighty-eight children whose intelligence quotients on either the Detroit Beginning First Grade Test or the California Test of Mental Maturity equalled or exceeded an equivalent Revised Stanford-Binet IQ of 120 were considered as mentally superior.

A guess-who type of test, developed on the basis of children-volunteered likable characteristics, was employed orally with each child in the first and second grades and in writing with the groups in grades three and four. For certain analyses, these characteristics were grouped in the categories, "frequency of association," "interpersonal relationships," "intellectual characteristics," and "physical characteristics."

Two types of comparisons were made. The first dealt with the proportions of mentally superior and non-mentally superior children who received any mention whatsoever on each characteristic. While there was no characteristic for which the proportion of non-mentally superior who received mention exceeded significantly the proportion of mentally superior, the proportion of mentally superior receiving mention exceeded significantly that of the non-superior on one interpersonal characteristic, "helps me," and on one intellectual characteristic, "bright or good in school work." Parallel findings were obtained by analyses made in terms of the several grade and socio-economic levels.

The second comparison dealt with differences between the proportions of mentally superior and non-mentally superior children accorded high choice status by their peers on each characteristic. High choice status was defined as a choice total on a characteristic exceeding chance expectancy at or beyond the .05 level of confidence. As in the case of the first comparison, the proportion of non-mentally superior did not exceed significantly that of the mentally superior on any characteristic. The proportion of mentally superior who were highly chosen exceeded significantly that of the non-superior only on the intellectual characteristic, "bright or good in school work." Analysis of the data for the several grade and socio-economic levels yielded similar results.

From a social point of view, it would seem that the negative finding has the greater psychological significance: On none of the characteristics, volunteered by the children as descriptive of their peers whom they liked best, did the non-superior children obtain more nominations than did their mentally superior classmates. This finding, coupled with the fact that the mentally superior children were nominated statistically significantly more frequently as "bright or good in school," suggests that the perceived "brightness" of the superior children was accompanied by no general social devaluation.

Microfilm $2.00; Xerox $5.20. 102 pages.

THE RELATIONSHIP BETWEEN CHILDREN'S DRAWINGS AND SENSITIVITY TO ENVIRONMENTAL SOUNDS

(L. C. Card No. Mic 59-752)

Charles Bruce Carter, Ed.D.
The Pennsylvania State University, 1958

The Problem

This study was designed to determine if a relationship existed between the artistic level of a child and his auditory sensitivity to environmental sounds in grades one through five.

The artistic level of the child was determined by experienced judges. A taped sound test of actual environmental sounds was designed to determine auditory sensitivity.

Procedure

A pilot study, dealing with sixty third grade children, was done in a mining and farming community in northern New York. Three drawings were collected from each child

over a two month period and analytical criteria were applied by three judges. Motivations for these drawings stressed the home and school environments, for example, "I Am Helping Around Home" and "We Are Passing Through the School Cafeteria Line."

After each child had been examined by the school nurse to determine whether or not any hearing impairments existed, a sound test of actual environmental sounds was taped and administered. On the tape, the sounds had been numbered verbally. The children were asked to number from one to ten on a piece of paper and after each number to identify the corresponding sound they heard. The papers were then collected and scored.

A correlation of .70 was found to exist between the art achievement scores and sound test scores. This correlation indicated that a positive, high, significant relationship existed between these two measures.

Is the relationship over five grades between artistic achievement and sensitivity to environmental sounds constant, or is there some other pattern emerging? The range of children was expanded to cover grades one through five, twenty children in each grade. The same methods of motivation and collection of art work were maintained. The number of sounds on the tape increased from ten to twenty environmental sounds. The sound test was administered by grade as in the pilot study with the exception of the first grade, where each child was tested individually in a separate room and each childs' oral answers were recorded by the investigator.

To determine the relationship between art achievement scores and sound test scores, the statistical analyses of the Pearson product moment correlation, the t test of significance of the mean differences, partial correlations, multiple correlations, and the Z transformation of correlation were computed. An analysis of item relationship was applied to the sound test to determine the test items' validity. A Kuder Richardson formula was used to determine the reliability of the taped sound test of actual environmental sounds.

Conclusions

From the data collected in this study the following conclusions are presented.

1. There is a significant developmental relationship between auditory sensitivity to environmental sounds and art achievement, reaching a high point at the third and fourth grade levels.
2. Although a developmental trend in sensitivity to environmental sounds is observed up to the fifth grade level, the difference between any grades one through five is not significant.
3. At the third grade level, mental age and sound discrimination are highly correlated, (.63) which is significant at the .01 level of confidence.
4. The relationship between mental age and sound discrimination at the fifth grade level reveals a non-significant .04 correlation.
5. The taped sound test of actual environmental sounds is a reliable test to measure children's sound discrimination as indicated by the high, positive, significant .82 reliability coefficient, obtained from the sound test scores of the one hundred children, comprising the population of this study. Microfilm $2.00; Xerox $4.00. 73 pages.

CARL G. JUNG'S POINT OF VIEW AS A GUIDE TO COUNSELING

(L. C. Card No. Mic 59-1169)

John Francis Hartman, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Alanson H. Edgerton

This study discusses Jung's psychological approach to the individual and its possible value as an aid to counselors. The method employed is that of illustration, analysis and elaboration of Jung's views. Comparisons are drawn between Jung's ideas and other concepts of counseling. The study is oriented toward the "average" individual who seeks counseling.

A short introduction to Jung is given in Chapter I. In Chapter II Jung's conception of the psyche and its manifestations are presented and examined. These concepts are discussed in connection with his views on philosophical and religious problems, the resolution of which he feels is important to individual well-being. Discussion is given to Jung's conviction that moral relativism, materialism and other reductive views of human nature can be detrimental to an individual's maintenance of a healthy psychic condition. His views are discussed in a non-denominational contest that includes the importance of sound spiritual values. Jung's aim is to help a client establish a psychic condition in which he can gain new and broader insights into values he has rejected or with which he may not even be conversant.

Chapter III compares Jung's concepts of the counseling situation with concepts of client-centered counseling. Jung's attitude of "unprejudiced objectivity" indicates he would grant a certain value to the client-centered approach in severe cases. After a certain point, Jung feels that the client's ideas must be challenged provided he accepts such challenge reasonably. Therapy is then conceived as a process of education that frees the client from narrow ideas that "possess" him. If success is achieved, both counselor and client undergo change and improvement.

Chapter IV examines Jung's opinions on the feasibility of using statistical methods for assessment of an individual's mental qualities. Standardized tests, i.e., those using norms for the interpretation of results, are discussed. It seems Jung would be extremely cautious in using these instruments. His explicit statements stress the extreme difficulty in representing numerically such ambiguous concepts as intelligence, ability, aptitude, emotionalism and stability. Jung's experience with the complexity of the human mind results in a view of each individual as an unique phenomenon who is not readily understandable in terms of norms and averages. The chapter recognizes that standardized tests do have value when properly understood and applied. This involves their limitations and possibilities as conceived by pioneers in testing techniques.

The general conclusions are difficult to state briefly. Most important is Jung's insistence that psychology must remain open-minded with respect to either psychical or physical realities. The existence of ultimate reality must be entertained in order to maintain this open-mindedness. Reductive theories, or techniques that limit one's conception of the human personality, are not only undesirable but harmful to the progress of psychological science. Scientific as well as spiritual narrow-mindedness must be

avoided. Formulae, for use in either treatment or education of the individual, are considered inadequate.

Finally, it is felt that for a counselor the ultimate deciding factor in a successful counseling relationship is, to use Jung's words, "your own creative personality." It is felt that many of Jung's ideas can be valuably employed in counseling individuals whose difficulties suggest unresolved philosophical or religious problems.

Microfilm $2.05; Xerox $7.20. 154 pages.

CONFIGURAL ANALYSIS OF MMPI SCORES WITH SPECIAL REFERENCE TO STUDENT TEACHERS IN NURSING EDUCATION

(L. C. Card No. Mic 59-1272)

Joe Hogan, Ph.D.
University of Minnesota, 1958

The purpose of the present study was to investigate the relationship of scores on the MMPI to success in student teaching. Students selected were 145 females at the University of Minnesota majoring in Nursing Education who were registered for two quarters of practice teaching. Eighty students registered during 1954-56 comprised the original group; sixty-five students enrolled during 1956-58 formed the cross-validation group.

Students were divided into "good," "medium," and "poor" groups according to the grade obtained during their second quarter of practice teaching. The two student teaching supervisors were then asked to re-rate independently each of the students. These re-ratings were based on summary sheets written by supervisors during the student's second quarter of practice teaching, with all identifying information concerning the student and the original grade withheld. Chi-square analysis of these re-ratings was three-fold: comparison of supervisors on re-ratings, and comparison of each supervisor with the original ratings. In all instances, analysis indicated rejection at the .001 level of the hypothesis that ratings were independent. Raters agreed between themselves on 92.7 per cent of the re-ratings, Rater I agreed with the original ratings 80.2 per cent of the time, while Rater II agreed with the original ratings in 79.5 per cent of the cases.

Analysis of MMPI profiles of the students consisted of two parts. First, analysis of MMPI signs was made, and second, the ten best signs were combined to determine their relationship with practice teaching success.

Forty-four MMPI signs were analyzed with chi-square, the ten best signs being as follows:

1. Ma 48-60 with Pd 46-58.
2. K $\geq$ 60 with Pd highest scale.
3. Hy and Pd two highest scales.
4. Pd _ Mf $\geq$ 20.
5. K $\geq$ 60 with Hy highest scale.
6. Mf $\geq$ 55.
7. K $\geq$ 60 with Ma highest scale.
8. Hs + D + Hy > Pa + Pt + Sc by five points.
9. Hs + D + Hy > Pa + Pt + Sc by ten points.
10. Mf $\leq$ 40.

Four of the ten signs (3,5,8, and 9) were considered "negative," i.e., they occurred with greater frequency in the poor group of students. As a result, the non-presence of these signs was considered to be a positive feature. In combining these signs, then, the number of positive signs (plus the non-presence of negative signs) was totaled.

It was found no student possessed more than seven signs on a profile. Divisions of "good," "medium," and "poor" students were made in relation to the number of signs possessed. If this procedure of combination of signs were to be valuable, it would be necessary for the poor students to have few MMPI signs, while the better students possessed several signs.

Comparison with "base rates" was then necessary. The "base rates" in this study were the percentages of good students (the combined "good" and "medium" groups in this phase), or 87 and 80 per cent in the original and cross-validation groups respectively. There was some improvement over the base rates for "good" students when groups were divided into those possessing 0-2 and 3-7 MMPI signs. At the same time, the large number of "poor" students misclassified essentially negated the results for "good" students, and made overall prediction below base rates. Possession of a few MMPI signs (less than three) was infrequently found in the good groups, but many signs were often found with poor student teachers.

It was concluded that the use of a series of MMPI signs, without further objective data, was not found to produce an overall predictive efficiency greater than base rates.

Microfilm $2.10; Xerox $7.40. 159 pages.

THE EFFECTS OF INITIAL GROUP EXPERIENCE UPON SUBSEQUENT INDIVIDUAL ABILITY TO SOLVE ARITHMETIC PROBLEMS

(L. C. Card No. Mic 59-1346)

Bryce Byrne Hudgins, Ph.D.
Washington University, 1958

Chairman: Louis M. Smith

Concern with the learning which occurs when children work together to solve problems led to the design and execution of this investigation. Earlier studies had shown that, when groups and individuals are presented with the same task, the solutions arrived at by the groups are superior to those achieved by subjects working alone.

There were two fundamental issues which the present investigation sought to resolve. The first of these was an explanation of the superiority of group to individual solutions. The second was an attempt to determine the existence of transfer effects from such a group problem solving situation to the situation where each subject worked by himself on similar materials.

The hypotheses tested by this experiment were as follows:

1. Individual ability to solve arithmetic problems will be improved more as a function of initial group experience than it will as a function of individual experience.

2. Individual ability to solve arithmetic problems is improved as a function of specifying the steps involved in arriving at solution.

3. The improvement of individual problem solving ability as a result of group experience is a function of the relevancy of intragroup communications to the processes involved in problem solution.

Subjects who participated in the experiment were 128 girls and boys from four fifth grade classes in the public schools of St. Louis. Eight subjects from each classroom were assigned to each of four experimental conditions. Prior to the experiment, subjects were matched on the basis of intelligence and arithmetic ability.

Experimental materials consisted of arithmetic problems adapted from the Stanford Achievement Test. A different set of thirty problems was used on each of the four days of the experiment. The same problems were presented to all subjects each day.

The experiment was conducted in two parts, designated as phase one and phase two. During phase one, subjects worked under the experimental condition to which they were assigned.

Condition A: Subjects worked in groups of four. They solved cooperatively thirty arithmetic problems each day. These groups were required to specify answers to questions designed to lead them to a solution of the problem.

Condition B: Subjects worked in groups of four. They solved cooperatively thirty problems each day, but were not required to specify the steps which led to solution.

Condition C: This condition was analagous to "A", but subjects worked individually.

Condition D: This condition was analagous to "B", but subjects worked individually.

Analysis of variance indicated that for the three days of phase one, subjects who worked in groups solved more problems correctly than did subjects who worked individually. This difference was significant beyond the .01 level.

Phase two was administered on one day, each class being tested on a different day. In phase two, each subject worked under the phase one "D" condition. One class received phase two the day after the completion of phase one, another class after two days, the third class after five days, and the last class twelve days after the first phase was completed. This arrangement was used to make possible a test of the permanence of the differences among subjects resulting from the training of the first phase.

Phase two results indicated that the arithmetic problem solving ability of subjects who had worked as members of groups in phase one was no greater than that of subjects who had worked individually in phase one. Likewise, the phase two scores of subjects who had been trained in the use of specification were not superior to those of subjects who had worked under non-specification conditions in phase one. Microfilm $2.00; Xerox $6.20. 127 pages.

AN ANALYTICAL STUDY OF THE RELATIONSHIP BETWEEN THE EXPRESSION OF FAMILIAL CONFLICT AND THE PRESENCE OF POTENTIAL COUNSELING PROBLEMS IN MALE ADOLESCENTS

(L. C. Card No. Mic 59-1276)

Elvet Glyn Jones, Ph.D.
University of Minnesota, 1958

The study investigated the association between the expression of familial conflict and the existence of counseling problems in high school boys. The study specifically explored differences in the counseling problems between students expressing familial conflict and students not expressing familial conflict. The rating of familial conflict was obtained by the use of a specially devised interview questionnaire consisting of 60 questions covering 10 areas of family life designed to evaluate familial relationships of adolescents.

The study was conducted between October 1956 and June 1957 at the Robbinsdale Senior High School, Robbinsdale, Minnesota. The school district had a population of approximately 50,000 of predominantly middle-class standards of living.

The design of the study involved the selection of two groups of boys from the Senior High School. A total of 201 boys, randomly selected from the total 660 boys by a method of stratified proportionate sampling, were interviewed and rated on the variable of familial conflict. The two study groups included: Group A consisting of 128 boys rated as not expressing familial conflict and Group B consisting of 73 boys rated as expressing familial conflict.

The investigation involved: (a) the construction and evaluation of the interview questionnaire; (b) the comparison of the two study groups on a variety of background factors including chronological age, grade level, father's occupational status, intelligence quotient, and Validity score on the Minnesota Counseling Inventory; and (c) the comparison of the two groups on selected areas of counseling problems including adequacy of vocational planning, discipline referrals during the school year, school attendance, referrals for failing grades, grade point average, teacher rating of classroom attitude and achievement, self-expressed problems on a problem check list, number of self-initiated counseling contacts, and psychometric scores of adjustment.

Evidence is presented in the findings of the study regarding the adequacy of the reliability and validity of the interview questionnaire on the basis of the comparison of the interview ratings with ratings from the Home Section of the Bell Adjustment Inventory, ratings by the use of written protocols, and ratings by counselors of the students' familial relationships.

The two groups were found to be similar in chronological age, grade level, and father's occupational status. Group A was found to be superior at the .01 level in measured intelligence. The two groups differed significantly at the .05 level on the Validity score with Group A presenting the greater evidence of distortion of answers.

The two groups were found to differ significantly at the .01 level in: adequacy of vocational planning, teacher rating of classroom attitude and achievement, number of discipline referrals, school attendance, total number of problems checked on a check list, frequency of checking

"family problems" on a check list, and in six of the seven scales of the Minnesota Counseling Inventory. The two groups differed significantly at the .05 level in the frequency of checking "personal-emotional" problems on a check list. No difference was found in the frequency of checking thirteen of the fifteen problems on the check list, in the score obtained on the Social Relationships Scale of the Minnesota Counseling Inventory, or in the number of self-initiated counseling contacts. In all cases of statistical significance, the group expressing familial conflict received the inferior ratings.

The results provide reasonably clear evidence that in the samples studied the students expressing familial conflict have potentially more counseling problems in the majority of the areas investigated. The results are interpreted as suggestive of the feasibility of research in the evaluation of the effectiveness of identifying students for special follow-up counseling on the basis of the verbal expression of familial conflict.

Microfilm $2.70; Xerox $9.40. 205 pages.

SOME ATTITUDE AND MEANING DIFFERENCES IN UNIVERSITY CULTURES

(L. C. Card No. Mic 59-1446)

Thomas Wallace Milburn, Ph.D.
Stanford University, 1959

Supervisor: F. J. McDonald

The problem investigated in the study was whether selection processes as reflected in the form of individual personality differences were an important element which could account for the perpetuation of distinctive group behavior. The subculture which exhibited distinctive group behavior used for this study was the college university. The behavior of male fraternity students in a major university had been for a number of years different from that of other male students, reflected in distinctly lower grades and more violations of regulations on the part of fraternity men. It was assumed that there would be a positive relationship between such behavior and certain attitudes.

Two attitude scales, a version of the semantic differential and the Berkeley E-F scale (Form 60A of the F scale), were administered to a group of freshmen students, half of whom had joined fraternities within the preceding week. It was hypothesized that fraternity-oriented freshmen would assign different meanings to 16 concepts (fun, self control, child, independence, hate, sex, studies, money, my mother, my ideal self, confusion, love, me, work, anxiety, and father) than would non-fraternity freshmen. Meanings were measured by scores on dimensions of evaluation, potency, and activity. It was further hypothesized that fraternity-oriented freshmen would have more authoritarian scores on the E-F scale than would non-fraternity freshmen.

On the basis of the assumption that through the enculturation process of the small living group (the fraternity) the differences hypothesized for freshmen would hold or increase, it was hypothesized further that differences between fraternity and non-fraternity seniors would exist, and also that these differences would be greater than those between the two groups of freshmen.

The freshman sample consisted of 112 students divided equally into fraternity-oriented and non-fraternity-oriented on the basis of their pledging record. They were tested without knowing the purposes of the measures administered. The senior sample consisted of 63 fraternity men and 63 non-fraternity men. All of them were volunteers to a letter invitation to participate in a survey of senior attitudes written on letterhead stationery from the Dean of Men's office.

The results of the study served to support the first two hypotheses but failed to support the last two. Fraternity-oriented freshmen proved more authoritarian and ascribed different meanings to several concepts, most significant of which were studies and sex. It was concluded that individual attitude and meaning differences were a factor in selection of new members to the subculture used in this study and thus were a factor in the perpetuation of distinctive group behaviors in this subculture. It was conceded that these differences could themselves have been consequent conditions to cultural antecedents. Although some differences were found between seniors, the differences were not significant ones, and it was concluded that the results therefore did not support the concept of enculturation as a means of perpetuating group behaviors.

Some ex post facto hypotheses were generated on the basis of the results, ones with presumed heuristic value. The results were tentatively explained on the basis of Festiner's dissonance theory. It was hypothesized that freshmen joining fraternities do so in an attempt to reduce dissonance among sets of cognitive elements. It was hypothesized too that university-wide culture could be a more important influence in changing the meanings and attitudes of individuals than small group membership. Certain limitations in generalizing from the data were also pointed out.

Microfilm $2.00; Xerox $3.80. 67 pages.

THE EFFECTS OF TWO INTERVIEW TECHNIQUES ON ACADEMIC ACHIEVEMENT AND CERTAIN NON-INTELLECTUAL FACTORS AFFECTING ACADEMIC SUCCESS

(L. C. Card No. Mic 58-5209)

Mary Rowena Moore, Ed.D.
Indiana University, 1958

Chairman: Kate V. Mueller

Problem. The purpose of this study was to evaluate two counseling techniques in relation to changes in certain arbitrarily defined non-intellectual factors affecting academic success and in final academic achievement in an elementary course in educational psychology at Indiana University.

Procedure. Three groups of 25 students each were drawn at random from two classes of elementary educational psychology. The total class population was 98 students, who were predominantly second semester freshmen. The randomness of assignment among the three groups was tested by comparing each group with the total group, using chi square techniques on rank in high school, the entrance examinations given by Indiana University, cumulative grade average through the fall semester, 1956, and The College Inventory of Academic Adjustment.

Group A served as the control group with no interview; Group B received personal counseling, the purpose being to make the course material meaningful in the light of past experiences and future teaching career and to increase self-insight; Group C received tutorial counseling which consisted exclusively of course content and assistance in clarifying textual material.

The criteria selected for use in evaluation of the interviews were the final grade achieved in the educational psychology course, over-all semester average during the period of the interviews, and The College Inventory of Academic Adjustment, which was administered before and after the interviews. The comparisons were calculated in part by use of the "t" test of significance, and in part by a comparison of mean scores.

The interviews were tape-recorded to ascertain differences in the interview procedures by an internal analysis of the typescripts. The first interviews of each group were used for analytical purposes, and a comparison was made of average response lengths to determine the differences in amounts of client participation between the two interview procedures. Interview components common to the tutorial and personal interviews, and components characteristic of each group were arbitrarily selected by the writer for comparative purposes.

Major findings. Major findings were as follows:

1. There was no statistically significant change at the five per cent level of confidence for any of the three groups between the fall and spring semester grade-point averages.
2. The final mean grade in the elementary educational psychology class was approximately .5 higher in the personal and tutorial groups than in the control group.
3. A statistically significant change at the five per cent level of confidence occurred between pre-test and post-test total and part scores on the CIAA for the students within the personal group. No change occurred within the tutorial group.
4. Analysis of the typescripts showed more client participation in the personal interview than in the tutorial interview procedure.
5. Two interview components common to the personal and tutorial interview procedures were found in greater amounts in the personal interview, which indicated more permissiveness and acceptance in this procedure than in the tutorial interview.
6. The most effective interview procedure used in this study was the personal interviewing technique, which affected both college adjustment, as measured by the CIAA, and the final course grade in elementary educational psychology.
7. The improvement in final course grade in the experimental groups would tend to emphasize the value for an interview with the student by the instructor of a course.
8. The improvement of the personal group on the CIAA test would tend to emphasize the importance of a general counseling program on the college and university campus.

Microfilm $2.50; Xerox $8.60. 189 pages.

MENTAL TEST PERFORMANCE AS A FUNCTION OF PAYOFF CONDITIONS, ITEM DIFFICULTY, AND DEGREE OF SPEEDING

(L. C. Card No. Mic 59-560)

Mohammed Younus Quereshi, Ph.D.
University of Illinois, 1958

This study was designed to investigate the influence of various payoff (motivational) conditions both separately and in conjunction with variation in item difficulty and degree of speeding on mental test performance as measured by a test of letter-series items. The subjects were 41 college freshmen, sophomores, and juniors. Of special interest was the investigation of the effects of motivational changes on (a) the mean performance of the group, (b) the differential response of individuals to motivation while other variables are held constant, and (c) the differential effect on behavior when a motivational condition is combined with a certain difficulty level or time limit. The data were analyzed both by analysis of variance and factor analysis taking into consideration the number of (a) correct solutions, (b) incorrect solutions, and (c) omitted problems. The application of factor analysis was necessitated by the need to describe and interpret the sources of variation found to be significant by analysis of variance.

The results indicate that motivation as defined and manipulated (by various rules of payoff) in this study does not only significantly influence the mental test performance of the group as a whole but also has significant differential effect on behavior. Moreover, a certain motivational condition combined with a particular difficulty level produces a unique and significant change, in the behavior of certain individuals, not predictable by either of these sources alone or by a combination of any two of them. This influence shows up significantly in the analysis of wrongs but not that of rights.

Contrary to the general practice in group intelligence testing of assuming that all individuals taking a test are equally susceptible to test directions, the results of this study indicate that they are influenced differentially if the wrongs and omissions are taken into consideration. For obtaining a representative estimate of a particular segment of behavior, adequate checks and balances have to be developed to control this differential effect.

The evidence also suggests that tests composed of relatively easy items, short or long time, provide a better measure of General Ability, as defined by letter-series behavior, than tests involving difficult items and short or long time. Also, when the test items are relatively easy, allowing generous time does not improve the efficiency of a test as a measure of this ability.

The shift in the meaning of wrongs and omissions as the testing conditions are changed has an important implication for the scoring formulas commonly applied to scores on most group intelligence tests. It suggests that in order to keep the psychological meaning constant a shift in the scoring formula is necessary whenever the testing conditions change the meaning of wrongs and omissions.

A number of personality characteristics such as (a) Adaptive Risk-Acceptance, (b) Brashness, and (c) Marking compulsion have been discovered to be responsible for individual differences with respect to the influence of payoff, difficulty, and speeding. The amount of variance contributed by these factors indicates that they have to be taken

into account in the development, use, and interpretation of tests. A concept of ability can be developed that incorporates such factors into its definition.

The use of analysis of variance and factor analysis as supplementary techniques seemed to have some potential advantages over the use of either of them alone. This is indicated by the fact that the significance of various sources of variation can be easily determined by the former while the latter can help describe the interpret them.

Microfilm $2.00; Xerox $4.40. 83 pages.

EFFECTS OF INTERNAL AND EXTERNAL REINFORCEMENTS ON EXPECTANCIES OF MENTALLY RETARDED AND NORMAL BOYS

(L. C. Card No. Mic 59-1116)

Daniel Ringelheim, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Rue L. Cromwell

The present study utilized constructs within the framework of Rotter's social learning theory to test the predictive value of assumptions that 1) the mentally retarded hold somewhat lower generalized expectancies for success than do their normal counterparts, and that 2) these differences are manifested in verbal expectancies. The reinforcing factors influencing expectancy (such as internal and external reinforcement, strength or weakness of success or failure) were also examined.

Forty-eight normal and 48 mentally retarded subjects, drawn from regular and special classes and group-equated with respect to mental age, were administered 24 trials on the Cromwell Vertical Life Apparatus. In this task the subject pulled a cord which vertically raised a carriage retaining a steel ball toward a designated goal point. Unknown to the subject, the ball was magnetized to the carriage and his performance was controlled precisely by the experimenter's use of a hidden demagnetizing switch. Before each trial, subjects wagered from one to eight chips, depending upon the degree to which they expected to reach the designated goal.

The normal and retarded groups were each divided into four subgroups differing in controlled performance schedules. Group I had a continually increasing performance, at first falling far short of the designated goal (and losing chips) and then far surpassing the goal (and winning chips). Group II had a continually decreasing performance, at first surpassing the goal and finally falling below it. Group III had an initial successful, increasing performance followed abruptly by a decreasing, unsuccessful performance. Group IV had an initial decreasing, unsuccessful performance, followed abruptly by an increasing, successful performance.

Contrary to predictions, no difference in level of betting behavior between retarded and normal groups was found in the initial trials. This negative finding was discussed with respect to positive findings of other studies which inferred expectancy from motor, rather than verbal, performance. Further, no differences between retardates and normals were found in variability of betting on the initial trial.

Contrary to predictions, subjects in both groups failed to show verbal expectancy changes as a function of the direction of change in their performance. The latter variable was examined independently from presence or absence of external goal achievement.

As predicted, however, changes in expectancy occurred as a function of whether or not the external goal was achieved and chips were won. The one exception, where the presence or absence of external goal achievement failed to predict expectancy change, was within a block of continuous failure trials with no preceding success. In this situation, subjects did not show the expected decrease in level of betting. An additional finding, contrary to prediction, was that verbal expectancies did not differ as a function of whether initial performance was a strong or minimal success or failure. Winning chips with an excellent performance vs. minimal success (or losing chips with a very poor performance vs. minimal failure) led to no differential change in stated expectancy.

The findings suggest a need for further evaluation of how expectancies change and of the structure underlying the assumed differences between the normal and the mentally retarded. Educational implications of the findings were also discussed.

Microfilm $2.00; Xerox $5.00. 99 pages.

THE EFFECT OF WESTERN EQUINE AND ST. LOUIS ENCEPHALITIS ON LEARNING ABILITY OF SCHOOL-AGE CHILDREN

(L. C. Card No. Mic 59-1428)

Gilbert Martin Shimmel, Ed.D.
Stanford University, 1959

Supervisor: F. J. McDonald

This study was designed to test the general hypothesis that an attack of Western Equine or St. Louis Encephalitis would have a measurable and detrimental effect on the intelligence and achievement test performance of children who were of school age at time of onset of the disease. It was done as part of the long-term follow-up study arising out of the 1952 epidemic of encephalitis in California. This follow-up is supported by a grant to the Stanford School of Medicine and School of Education from the National Institutes of Health.

Subjects in the study were children who, when between the ages of six and sixteen, suffered a clinically diagnosed and laboratory-confirmed case of one of these diseases.

Basically the study used a matched-pair design. The investigator visited some seventy schools in the search for school records of these subjects which would include results of tests taken before onset of the disease as well as after recovery. Upon finding such a record, the record of a matched control subject was picked from the same school. Criteria used for matching were age, sex, race, father's occupation, and pre-disease I.Q. matched within three points.

A total of 31 matched pairs constituted the final sample. An additional 54 incomplete records were obtained which lacked pre-disease data but were examined and used to corroborate the findings regarding the matched group.

Data gathered to make comparisons came solely from school records and consisted of performance scores on

intelligence and achievement tests taken most immediately prior to onset of the disease, and on all tests taken subsequent to recovery.

To assess significance of observed differences, the "t" tests for small samples were employed. Besides comparing data for total groups, analysis was also done by subgroups to investigate possible differences that might be obscured in the total comparisons. Subgroups used were disease etiology, sex, age at onset, and diagnosed severity of acute stage of the disease.

In general the results of this study showed that the mean intelligence scores for the experimental group were lower on the post-disease test than were those of the control group. This difference was significant at the .01 level. In subgroup analysis St. Louis Encephalitis victims showed a far greater drop than Western Equine, the younger group at onset showed greater drop than the older, and girls showed the greatest drop of any identifiable sub-group. Consideration on basis of judged severity of acute stage showed no significant differences between those judged mild and those rated moderate through severe.

Comparison of achievement test performance gave similar results. Although both groups were similar and above grade level on the pre-disease test, the experimental group averaged one-third year below grade level in arithmetic and one-fourth year below in reading, while the control group averaged one-half year above grade level in both.

Comparison of the two groups on second intelligence tests taken at least two years after the first post-disease test revealed differences still remaining which were significant at the .01 level.

Examination of the incomplete records revealed no evidence that would tend to contradict the above findings.

The results of the study showed that the children who had had Western Equine or St. Louis Encephalitis showed a drop in intelligence and achievement test performance which seemed to be permanent rather than transitory. The size of the difference, while statistically significant, was not so great as to be seriously crippling to learning ability.

Microfilm $2.00; Xerox $4.00. 73 pages.

SOME CORRELATES AND DETERMINANTS OF NATIONAL STEREOTYPING

(L. C. Card No. Mic 59-1455)

Sigurd Stautland, Ph.D.
Stanford University, 1959

Three general hypotheses about correlates of national stereotyping were derived after a survey of the research and theoretical literature in the field. The three variables considered as behavioral correlates of national stereotyping were levels of education, mental ability and social class. In addition to these, age and sex were predicted possible variables and were therefore included in the study.

A sample of 288 senior high school students was given a test of stereotyping and a questionnaire to determine their age and social class position. The test of stereotyping was an adaption of Osgood's "Semantic Differential" in which the subjects were asked to judge six nationality groups on ten scales. Social class position was determined on the basis of father's occupation and parents' education. Mental ability was operationally defined as the subject's score on California Short-Form Test of Mental Maturity, Intermediate 1950 S-Form.

The test of stereotyping was tried for reliability, yielding a test-retest correlation-coefficient of r = .93. Siegel's test of stereotyping was used as validation criterion, and the correlation between the two tests was r = .39, t = 3.93, P<.001.

The data were subjected to three kinds of statistical analysis: (1) a correlation coefficient was found expressing the relationship between stereotyping and the appropriate variables, (2) an analysis of variance was made to find the difference of the stereotyping scores between the groups in question with covariance adjustment for the appropriate variables, (3) "t" tests were used for finding the difference of the mean stereotyping scores of the levels of education and the significance of the correlation coefficient.

The hypotheses and the experimental results were:

Hypothesis I: Level of education is a behavioral correlate of national stereotyping.

The results did not support the hypothesis, yielding a t = 2.72, P<.001 for the difference between tenth and eleventh grade, and a t = .68, P>.4 for the difference between eleventh and twelfth grade.

Hypothesis II: Mental ability is a behavioral correlate of national stereotyping.

The results supported the hypothesis yielding an r = -.52, t = 11.12, P<.001.

Hypothesis III: Social class status is a behavioral correlate of national stereotyping.

The hypothesis was not supported. The statistical results yielded r = -.03, t = .58, P>.05.

Hypothesis IV: Age is a behavioral correlate of national stereotyping.

The results did not support the hypothesis. The correlation between age in months and stereotyping was r = .04, t = .78, P>.05.

Hypothesis V: Sex is a behavioral correlate of national stereotyping.

The results supported the hypothesis. An analysis of covariance with mental ability as uncontrolled variable gave an adjusted F of 6.40, P<.02.

Microfilm $2.00; Xerox $3.80. 68 pages.

AN EVALUATION OF THE READING AND STUDY METHODS PROGRAM OF THE UNIVERSITY OF KANSAS FOR THE YEARS 1953 TO 1956

(L. C. Card No. Mic 58-3576)

Vincent L. Sternitzke, Ed.D.
University of Kansas, 1957

This evaluation concerns itself with freshmen enrolled in the Reading and Study Methods program, an eighteen-meeting, voluntary, non-credit service to University students.

A major portion of the evaluation is focused upon the fall of 1956 class as these students were actually enrolled at the time of the study. Initial and final tests of the Co-operative Reading Tests C2 and of the Brown-Holtzman Survey of Study Habits and Attitudes were administered.

Testing by t-ratios produced the following results: (1) Vocabulary gains were significant at the one percent level of confidence. (2) Speed of comprehension gains were significant at the five percent level. (3) Level of comprehension gains were significant at the five percent level. (4) Both males (N = 128) and females (N = 41) showed gains in study habits significant at the one percent level of confidence. The Minnesota Multiphasic Personality Inventory was also administered and correlation coefficients of MMPI scales with gains in reading vocabulary, reading speed, and study habits were tested for significance for men and for women separately. The results show no significant pattern except that masculinity of interest seems to be positively related with improvement in reading speed and study habits for both sexes.

Grade-point averages were calculated for both and experimental and a control group of 1955-56 students, each consisting of 65 subjects. The differences of the two groups were tested by variance and covariance with non-significant results even after the correction for differences in academic potential was applied. Forty-nine percent of the experimental group and 51 percent of the control group did not return to the University the following fall.

A specially designed rating scale was mailed to all freshmen members of 1954-55 classes who were currently enrolled at the University. It was found that 96 percent of the 45 raters returned the scale. Their modal responses are summarized as follows: These students said that (1) they enrolled because they felt it would be a great help to them, (2) they were helped somewhat, (3) they improved their study habits, (4) they increased their reading speed very little, (5) improvement in their reading comprehension may have been a result of the course, (6) the course caused their grades to improve slightly, (7) they would recommend the course to practically any college student, (8) their morale was improved slightly, and (9) the class meeting were fairly interesting. High and low achievers and high and low intelligence groups responded differently to some of the items. The high achievers and the more intelligent groups were generally more favorable in their ratings than were the lower criterion groups.

This same rating scale was sent to 1953-54 students who completed the course their freshman year and who were currently enrolled as seniors. Of the eleven raters, 82 percent returned the scale. Responses approximated those of 1954-55 subjects except for (2), (6), and (7) above where they gave lower ratings and (4) where they gave a higher rating.

Conclusions: Students participating in the Reading and Study Methods program at the University of Kansas made significant gains in reading skill and in study habits when measured by standardized tests and inventories, but did not register any better grade averages one year later nor did they return for the sophomore year in significantly greater numbers than students not participating in the program. Student ratings of various aspects of the program were generally quite favorable.

Microfilm $2.85; Xerox $9.80. 218 pages.

A STUDY OF PATTERNS IN MOTIVATION AMONG ENTERING COLLEGE FRESHMEN AND OF THE RELATIONSHIPS BETWEEN MOTIVATION AND CERTAIN PERSONALITY FACTORS

(L. C. Card No. Mic 59-988)

James Wilson Truelove, Ed.D.
University of Alabama, 1958

The purposes of this study were: to determine the nature of the patterns of motivation of male and female freshmen entering the various schools and colleges of the University of Alabama toward ten fields of study commonly offered in high schools and colleges; to determine the correspondence between scholastic ability and motivation toward the several fields of study; and to determine the relationships between four personality factors, namely, hysteria, masculinity-femininity, psychasthenia, and social withdrawal tendencies, and motivation toward the several fields.

The instruments used in this study were three of the tests administered in the freshman testing program at the University of Alabama, the Fields-of-Study Motivation Record (FOSMR), the Cooperative School and College Ability Test (SCAT), and the Minnesota Multiphasic Personality Inventory (MMPI). The SCAT and the MMPI are widely available, but the FOSMR, an experimental form of which was copyrighted in 1956 by Dr. V. M. Sims of the University of Alabama, has not been published.

In order to study the patterns of motivation, FOSMR scores for approximately 1500 freshmen were analyzed for differences, charts were prepared to show differences graphically, and tests of significance of variability and for significance of differences among various groupings according to sex and school were made.

To determine the relationships existing between ability and motivation and between personality characteristics and motivation, FOSMR scores were correlated with SCAT scores and with selected MMPI scores. A random sample of approximately 300 students' test records was selected for this phase of the study.

Some conclusions of the study were:

a. There are distinctive differences between the sexes in their motivation toward the various fields of study. Women are significantly more motivated toward the fields of art, English, foreign language, music, and vocational education than are men, while men are more motivated than women toward the fields of history, mathematics, physical education, and science. Both are about equally motivated toward the field of social studies.

b. There are distinctive patterns of motivation for students enrolling in each of the various schools and colleges of the University. These patterns differ significantly by school and by sex within the schools.

c. Although general scholastic ability scores and motivation are not highly correlated, more significant correlations were found than would be expected to occur merely by chance. Fourteen of the 60 coefficients were significant at the .05 level or better, but the highest coefficient was only .46.

d. In addition, personality characteristics and motivation were not found to be highly related; again, the number of significant relationships were greater than by chance--20 of 80 coefficients of correlations computed were significant, yet the highest coefficient was only .29.

On the basis of these findings, it is recommended that:

1. Further work be done in establishing the worth of the FOSMR. Results of the present study show that the FOSMR differentiates motivation between the sexes, between fields of study, and between divisions (schools or colleges) of a University. Furthermore, the FOSMR scores are not closely related to general scholastic ability scores, but they are related to grades. If the scores from both types of tests are associated with grades and are not associated with each other (as the case seems), use of both would improve prediction of school success.

2. Further study be conducted of relationships between specific abilities and motivation.

3. Motivation scores for particular fields be studied in relation to scholastic success. Through factor analysis it might be determined that certain patterns of motivation are closely related to success in specific fields of study.

Microfilm $4.45; Xerox $15.00. 348 pages.

THE DEVELOPMENT OF AN EMPIRICALLY CONSTRUCTED SCALE FROM THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY FOR IDENTIFYING STUDENTS LIKELY TO BE ELECTED TO POSITIONS OF LEADERSHIP IN COLLEGE EXTRA-CURRICULAR ACTIVITIES

(L. C. Card No. Mic 58-2984)

Edward Victor Voldseth, Ph.D.
State University of Iowa, 1958

Chairman: Associate Professor Kenneth B. Hoyt

This investigation sought to determine whether persons elected or likely to be elected to major positions of leadership in selected collegiate organizations have personality characteristics, as measured by their responses to items comprising the Minnesota Multiphasic Personality Inventory, which distinguish them from individuals not elected or unlikely to be elected to such positions in similar universities. The problem was approached from two directions: First, comparisons were made with MMPI scales developed by the authors of that instrument and by other investigators. Second, comparisons were made with an experimental scale which was empirically developed as part of this study. The collegiate organizations whose major elected leaders were selected for investigation were structured and continuing groups in which membership is based relatively more on factors other than professional interest and/or academic achievement.

Dichotomously conceived populations of leaders and other students of each sex at the Universities of Iowa, Minnesota, and Wisconsin were randomly sampled. The Iowa samples of men leaders and other men, and of women leaders and other women, were approximately equated as to age, college, and class. The Minnesota and Wisconsin samples of each sex consisted of pairs of leaders and other students matched according to age, college, class, and academic aptitude. Individual sample sizes at the three universities ranged from 43 to 68.

By separate analyses of responses to MMPI items by the criterion and control samples of each sex at Iowa and at Minnesota, an experimental scale whose men's form consists of 32 items and whose women's form consists of 41 items was developed. The two forms of the scale share only two identically scored items.

On existing MMPI scales, (including its authors' nine clinical scales and three validating scales, Drake's Si scale, and Oettel's leadership scale,) no significant difference found between means of samples at one university also was found between samples of that sex at either of the other two universities. Locally significant differences were: Mf scores of men leaders were higher than those of other men at Iowa; Ma scores of men leaders were higher than those of other men at Minnesota; Minnesota women leaders and Wisconsin men leaders scored lower on Drake's Si scale and higher on Oettel's leadership scale than did other Minnesota women and Wisconsin men, respectively.

Significant differences between the Wisconsin samples of leaders and other students of each sex were obtained with the appropriate form of the experimental scale developed with Iowa and Minnesota subjects. Because the Wisconsin subjects' MMPI answer sheets which were used in this investigation had been completed by them when they entered that University, the experimental scale demonstrated statistically significant utility for predicting whether an incoming Wisconsin student is likely or unlikely to be elected to a position of leadership in the selected extra-curricular organizations.

Relationships between each form of the experimental scale and other measures were determined with other Wisconsin samples of 100 senior men and 100 senior women selected without regard to leadership status. In the order of decreasing magnitude, the men's form of the scale correlated positively with Mf, Hs, and Hy, and negatively with college grade point average, all at significant levels. The women's form of the scale correlated positively with Oettel's leadership scale, Ma, and academic aptitude as measured by the ACE, and negatively with Si, Pt, D, Sc, F, and Hs, all at significant levels.

This study indicates that leaders in similar ogranizations and settings have measurable personality characteristics in common and supports the view that leadership is the product of concurrent personality and situational factors.

Microfilm $2.15; Xerox $7.60. 161 pages.

EDUCATION, TEACHER TRAINING

THE INTERNSHIP CONCEPT OF AMERICAN TEACHER EDUCATION AND ITS APPLICATION TO PHILIPPINE SECONDARY TEACHER EDUCATION

(L. C. Card No. Mic 59-1421)

Natividad Macaraeg Macaranas Allen, Ed.D.
Stanford University, 1959

Supervisor: R. M. Bush

Problem

The purpose of this study is to (1) analyze the internship concept in American teacher education, (2) develop a

set of criteria for appraising the adequacy of internship programs for secondary school teachers, and (3) propose a program of teacher internship on the basis of these criteria which might be used and tested in the Philippines.

Methodology

Two research methods were used in this study:

(1) Historical and documentary analysis in which the historical development of internship in the professions was traced, philosophical literature and psychological studies were analyzed, and the factors of teaching competence and the current debate in American education relevant to teacher internship were studied; and

(2) Normative-survey of existing programs of internship.

Results

(1) The criteria of a sound internship program that evolved out of the critical analysis of the internship concept are as follows:

1. The internship program is a program involving (a) general or liberal education, (b) professional education, and (c) specialized education, as background for the internship teaching.
2. The internship program has been developed with a basic philosophy or purpose defined by the cooperating school district and the training institution to guide its operation.
3. The internship program has a system of selective admission.
4. The internship program provides an internship period which has the following characteristics: (a) a substantial block of time that enables the trainee to assume full teaching experiences, to carry full teaching responsibilities, and to meet actual teaching problems; (b) a continuous program of professional and specialized education to supplement the background of the intern; (c) seminars conducted by the university staff and the school district supervisors as a device in guiding the professional development of the intern; and (d) cooperative and full time supervision in which the cooperating school districts and the intern training institutions assume responsibilities.

(2) Internship may be defined as a phase of teacher education in which a capable student with sufficient liberal, professional, and specialized education background to enable him to teach, further learns and broadens this background by teaching in the field as a full time teacher but under competent supervision for the purpose of making the transition from college life to teaching a continuous process of growth and development.

(3) Two ways of adapting the internship concept in the Philippines are proposed:

1. Five year program, four years of which are devoted to the concurrent offering of general education, professional education, and specialized education, and the fifth year devoted to teaching internship in which the interns pursue continuous general, professional, and specialized preparation.
2. Special internship program for the liberal arts graduates who take professional courses before the internship, during the internship, and after the internship.

(4) Problems which are financial, supervisory, administrative, and instructional in nature may be encountered in adapting the proposed programs in the Philippines.

Conclusions

A sound internship program seems to offer the following advantages for secondary school teachers:

(1) Opportunities for growth and development of the intern (a) personally - the intern grows and develops with a wholesome personality because he comes in contact with personalities of varied backgrounds, interests, and capabilities in the school and in the community; and (b) professionally - the intern is given an opportunity to grow professionally before the internship, during the internship, and after the internship.

(2) Adequate guidance and supervision where these are most needed by the beginning teacher.

(3) Opportunity to grow in competence and effectiveness while engaged in teaching and in the continuous pursuit of general, professional, and specialized knowledge.

(4) Application of sound principles and theories of learning to actual classroom situations.

(5) A sense of joy and pride in being a member of the teaching profession emanating from the fact that only the best are chosen to enter into the profession.

Microfilm $4.05; Xerox $13.80. 316 pages.

PROVIDING PROFESSIONAL LABORATORY EXPERIENCES FOR EXPERIENCED ELEMENTARY SCHOOL TEACHERS

(L. C. Card No. Mic 59-1087)

Jess R. Beard, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Maycie K. Southall

The purpose of this study was to identify and describe promising practices in providing professional laboratory experiences for experienced elementary school teachers. The study was limited to teacher education institutions in Illinois in order to have uniform state certification laws affecting the amount of student teaching required for experienced elementary school teachers. Professional laboratory courses were studied at six Illinois colleges that were members of The American Association of Colleges for Teacher Education and that provided a student teaching program in a campus elementary school during the summer of 1956.

College publications were studied, visits were made to the campuses of the six cooperating colleges, and interviews were held with at least five selected faculty members at each institution. A questionnaire was prepared to ascertain the activities considered valuable by the experienced elementary school teachers who were undergraduate students and who had taken required student teaching courses at one of the cooperating institutions during the

1956 summer session. Approximately 56 per cent of the 240 questionnaires sent were returned. Data were summarized from the 115 usable returns. Another questionnaire was used to determine the activities experts in the field of teacher education would recommend for experienced elementary school teachers to have during a required student teaching assignment. Forty-three usable returns, or 55 per cent of the questionnaires sent, were received.

Findings of the Study

When the programs of the six institutions were analyzed, it was found that three colleges required the same number of hours of student teaching credit for the experienced teacher as for the inexperienced student. In addition to student teaching, four institutions offered special laboratory courses that carried student teaching credit to a limited number of experienced elementary school teachers. The number of student teachers assigned to a single classroom during the summer session ranged from one to twelve, with five being the typical number. A maximum of six to eight quarter hours of student teaching credit could be earned during the summer sessions which ranged from six to eight weeks in length.

The experienced student teachers reported seventy-six valuable laboratory experiences in which they engaged during the 1956 summer session. Nearly three-fourths of the activities reported as valuable by the experienced student teachers were also included in the ninety-six laboratory experiences recommended by the experts in teacher education. A majority of the experiences valued by the student teachers involved direct experience with children in a single classroom, while fewer than one-half of the activities recommended by the experts involved any contact with children.

The factors that the student teachers considered most important in contributing to a satisfying laboratory experience were: a teaching assignment that stimulated creative, non-repetitive teaching opportunities; a friendly, cooperative supervising teacher who gave helpful criticism and supportive supervision; an assignment to a well-equipped classroom with fairly normal children; a realistic student teacher-pupil-supervising teacher ratio; and clearly defined objectives and goals of student teaching.

The findings indicated that student teaching programs designed for the pre-service teacher-trainees do not meet the needs of experienced elementary school teachers. Furthermore, the evidence found in the six programs studied, in the activities valued by the experienced student teachers, and in the experiences recommended by the experts indicated that colleges need to find more and better ways of individualizing their professional laboratory programs in order to meet the widely varying needs of experienced teachers required to take student teaching to meet certification and graduation requirements.

Microfilm $4.20; Xerox $14.00. 325 pages.

A STUDY OF SOME BASIC GUIDING PRINCIPLES IN TEACHING SELECTED ASPECTS OF ELEMENTARY ARITHMETIC WITH IMPLICATIONS FOR EDUCATIONAL PRACTICE AND TEACHER EDUCATION IN THE PHILIPPINES

(L. C. Card No. Mic 58-5203)

Carmen Balderrama Carlos, Ed.D.
Indiana University, 1958

Chairman: Hanne J. Hicks

The purpose of this investigation was to study some of the basic principles underlying the teaching of selected aspects of elementary arithmetic and to make recommendations for the implementation of those that are found suitable and adaptable for use in educational practice and teacher education in the Philippines.

A checklist of generally accepted principles was worked out and submitted to a limited number of selected teachers and teacher educators to get their opinions as to the degree of relevancy and pertinence of each of the 98 principles in relation to the development of problem-solving abilities and skills in the fundamental operations. All the principles that were marked "essential" by all these people were selected for the study. The 25 principles finally selected were then used as a basis for the formulation of proposals for the improvement of educational practice and teacher education in the Philippines.

The following conclusions were derived from the findings:

1. When children enter school they have already acquired much number competency and therefore are ready to continue such learning. However, because of the wide range in amount of number knowledge of beginning children, provision should be made for differentiation in the instructional materials, procedures, and number experiences given them.

2. The inter-relationships of such factors as age, intelligence, maturation, and experiential background contribute to arithmetic readiness. Many first-hand experiences with numerical situations should be provided to promote readiness.

3. Meaning and understanding are significant readiness factors, for, when such factors are present, the child learns more readily and retains longer what he learns.

4. The use of manipulative and pictorial materials in arithmetic helps children learn and develop number facts, concepts, relationships, and generalizations. These materials should be selected in terms of the principles of learning and the objectives of education.

5. The selection and adoption for use of textbooks and other printed materials should take into consideration the vocabulary and content appropriate for children of all grade and age levels.

6. The textbook should be used as a general reference book, where children can locate help in checking on generalization or in preparing summary statements for identifying or clarifying points that are not yet understood.

7. Instructional materials could be made more effective by a well-planned system of organization and administration.

8. The meaning theory emphasizes understanding and meaning, rather than speed and accuracy.

9. A knowledge of child growth and development is of

prime importance in the development of an improved arithmetic curriculum. There is a need for differentiation of instruction within the classroom through flexible grouping.

10. The type of curriculum to adopt should be the concern of each school and should depend upon existing conditions. Whatever program is used, pre-planning on the part of the teacher is almost a necessity for effective teaching.

11. The simultaneous presentation of the relationships of addition and subtraction and of multiplication and division combinations, together with the interrelationships between these processes would cut down unnecessary practice, help maintain learnings, and make it easier for children to transfer principles learned to new number combinations.

12. Judicious practice has a place in the modern arithmetic program. It should follow after meanings and understandings.

13. Evaluation should be an integral part of instruction and learning in arithmetic. It should be made during the teaching-learning process to determine how well a child is achieving and to indicate points at which he is having difficulty.

14. Varied evaluative techniques and devices should be used to make up a complete program of evaluation in arithmetic. Such evaluation should include both the "tangible" and the "intangible" aspects of learning.

15. Evaluation, to be truly effective, should be a continuous and cooperative process. Administrators, teachers, parents, and learners should have an active part in evaluating arithmetic learning.

16. It is a consensus of opinion among leaders in the field that background mathematics course in addition to a methods course is essential in teacher preparation.

17. An in-service education program cooperatively planned and executed by teachers under the leadership of the administrative and supervisory staff would promote teaching competencies.

Microfilm $3.70; Xerox $12.40. 285 pages.

LEARNING ABOUT TIME ZONES: AN EXPERIMENT IN THE DEVELOPMENT OF CERTAIN TIME AND SPACE CONCEPTS

(L. C. Card No. Mic 59-1093)

Ozro Luke Davis, Jr., Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Harold D. Drummond

The purpose of this experiment was to determine whether children in the fourth, fifth, and sixth grades could profit from instruction in concepts of time and space relating to geographic time zones.

Experimental Design

Two classes each of fourth, fifth, and sixth grades were selected from six different Davidson County, Tennessee, elementary schools. One class at each grade level was designated as the experimental group, the other as the control group. The subjects were middle class white children. At the beginning of the experiment, there were no significant differences between the experimental and control groups with regard to intelligence, social studies achievement, and understandings about time zones. The experimental classes were taught a unit specifically embodying material relating to the development of an understanding of geographic time zones. The experimenter taught the unit to the experimental classes to control for variations in teaching method, learning materials, and subject matter presented. The criterion measure of time zone learnings was a test devised by the experimenter. This test was administered as a pretest, an immediate post-test, and a test of delayed recall. The data were treated by analyses of variance.

Findings

As a result of this experiment, the following conclusions were reached:

1. At the end of the experimental teaching period, the experimental classes had significantly profited from the instruction about geographic time zones and there were significant differences between the grade levels.

2. One month after the experimental teaching period, the experimental classes had maintained their superiority over the control classes and the significant differences between grade levels persisted.

3. The fourth graders gained more in their understandings than the sixth graders gained during the experimental teaching period. The experimental classes made a significantly greater gain in understanding than did the control classes.

4. There was no difference in the gains of understanding between grade levels during the time the pretest was given and the administration of the test of delayed recall, although there was a difference favoring the experimental classes over the control classes.

5. One month after concluding the experimental teaching period, the experimental classes continued to gain more understanding than the control classes and there were no significant differences in gain between grade levels.

Discussion

Adequate concepts are fundamental to clear thinking. The development of accurate concepts in the elementary school social studies program is an essential, yet difficult element of instruction since learning in this curricular area is highly verbal. Most social studies authorities call attention to the heavy concept load in this portion of the curriculum. They agree that some concepts of time and space, including understandings of chronology and the sphericity of the earth, are too difficult for children until late in their elementary schooling. This position has been justified on what is known about the nature and development of concepts and misconceptions found in children's thinking. This experiment indicates that instruction in aspects of the concepts of geographic time and space relating to time zones is profitable earlier than formerly thought possible. Rigid grade placement of various elements of the understandings considered in this experiment is impossible and undesirable. A need exists for continuity, sequence, and flexibility of planned instruction in the development of these concepts.

The results of this experiment raise serious questions about theories relating to instruction concerning certain concepts. Much additional experimental evidence is needed

to determine what concepts children can develop when they are guided into rich and meaningful experiences.

Microfilm $2.35; Xerox $8.20. 179 pages.

AN EVALUATION OF A COURSE IN TEACHING SCIENCE IN THE ELEMENTARY SCHOOL

(L. C. Card No. Mic 59-503)

Priscilla Jacobs Eccles, Ed.D.
University of Illinois, 1958

This study is an evaluation of a course in teaching science in the elementary school (Education 335) offered by the College of Education of the University of Illinois. The course includes a number of experimental features, particularly in the laboratory, which are the focus of interest.

The knowledge, skills, and attitudes characteristic of an elementary teacher adequately prepared to teach science are described and a number of studies pointing out the major areas of weakness in the average elementary teacher's preparation for science teaching are reviewed. From this seven needs are defined which must be met through the teachers' general education or professional training: (1) An adequate background in science concepts. (2) An understanding of the nature of science, how scientists solve problems, and the methods and attitudes of scientists. (3) A clear view of the aims and objectives that should guide science teaching in the grades. (4) Some skill in various teaching techniques, including the ability to help children find answers to science questions. (5) Knowledge of where to get materials, equipment, and references, how to choose appropriate supplies, and how to use them in the classroom. (6) Experiences in constructing and using simple apparatus for the purpose of demonstrating scientific principles. (7) A sense of pleasure in working with science, finding answers, trying things out, and interest in continuing this work in the classroom.

During the spring, 1957 semester two sections of Education 335 were organized. The first section was taught experimentally; the second section was planned as a more conventional course. The second section provided a group of students who were useful in comparing certain limited aspects of the work in Education 335.

The method of investigation was, primarily, observation. Tape recordings, anecdotal records, analysis of written work, interviews, and questionnaires were used. Some traits were also measured by means of objective tests.

This information is organized into reports on each student and includes discussion of student background, experiences in the laboratory, and changes in knowledge, skills, and attitudes which apparently resulted from these experiences.

These results are discussed and, for each of the seven areas of need, hypotheses are proposed as to (1) the extent of the need in the typical student who enrolls in the course, (2) the effectiveness of the experimental laboratory organization and teaching method of Education 335 in meeting these needs, and (3) the probable effect on the need of certain modifications in organization and method of the course. None of these hypotheses could be tested conclusively but the data that suggested the hypothesis or tended to support it are given. Suggestions for further investigations are made.

The study calls attention to the lack of precise information as to the effect of the teacher's knowledge, skills, and attitudes on the quality of her work in the field of science and the lack of suitable objective instruments to measure some of the traits considered important. The hypotheses suggest that the need in all of the seven areas defined is great and that very little student changes result in any area of need from a one semester course in teaching science in the elementary school.

A final statement points out the complexities involved in a teaching "method". At the present time the many decisions that need to be made in planning and teaching a course such as Education 335 must be based on the experienced judgement of the instructor rather than valid research data. Microfilm $3.20; Xerox $10.80. 245 pages.

LEARNING EXPERIENCES THAT PREPARE SCHOOL MUSIC TEACHERS FOR SELECTED ACTIVITIES

(L. C. Card No. Mic 59-1096)

William Shelton English, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Irving W. Wolfe

People teach well because they have learned to do so. Certain things have happened which developed their ability to handle specific activities adequately. The purposes of this study were to find out exactly what vocal school music teachers need to know and what they need to be able to do, then to determine what significant learning experiences best prepare the individual music teachers to do these things.

Ninety-six activities of the vocal school music teacher were studied to determine what significant learning experiences had been provided during the pre-service college education of the teacher.

Four hundred and fifty-two teachers from forty-four states participated in the study, listing learning experiences which they believed prepared them to be able to manage the selected activities adequately.

The teachers were asked to indicate whether or not adequate learning experiences were provided in their college education. They were asked to express their judgment as to what proportion of the ability to manage the specific activity adequately must be learned on the job, and what proportion of their present "know-how" they attributed to their college education.

The discovery and compilation of these significant learning experiences was the major purpose of the study. In addition, other findings suggest important implications for teacher training.

First, methods courses dealing with vocal school music should contain experiences which prepare the prospective teacher to establish and maintain cooperative relations with members of the school staff, parents, and other individuals and organizations of the community.

Second, in planning for course content, great care should be taken that teaching procedure such as instructor's reading from texts, lectures, and "one-way" discussions where students have little opportunity to participate should be

replaced or strongly supplemented by demonstrations of the various ways the anticipated activity can be managed.

Third, many teachers criticized the lack of opportunity to discuss their teaching weaknesses with those responsible for their education. The findings of the study indicate that the opportunity for guiding actual learning situations should be followed by at least one seminar or workshop.

Comments made by the teachers to clarify or explain certain suggested experiences revealed other ideas which have implications for teacher education. These comments indicate three areas of the teachers' education as being particularly significant.

The first area of learning was the background prior to college. This includes experiences gained at home, in elementary and secondary schools, and from private instructors. The second area was membership in the performing organizations during college years. The third area was the student teaching opportunities. Regarding the latter, particular emphasis was placed upon the need for actual teaching experience as well as upon the opportunities for observation.

The outstanding use for the findings of the study would come from a careful examination of the significant learning experiences. Using the experiences as a type of check list could be helpful to anyone responsible for the curriculum content for the education of music teachers. Even though certain experiences seem to be adequate, it is very possible that each additional experience provided could intensify the ability of some individuals and become, perhaps, the only way of reaching others.

Microfilm $4.50; Xerox $15.20. 351 pages.

IDENTIFICATION OF EXPERIENCES NEEDED TO FACILITATE THE FIRST YEAR OF TEACHING IN A SPECIAL SERVICES SCHOOL

(L. C. Card No. Mic 59-1056)

Stella R. Gervasio, Ed.D.
New York University, 1958

Chairman: Dr. Mary Beauchamp

Purpose

The study of the investigator was to analyze in detail the experiences of a group of eight first-year teachers enrolled in a graduate seminar in the School of Education, New York University, 1957-1958, designed to help them during their first year of teaching. The purpose of the study was to identify those experiences, materials, administrative relationships needed to facilitate the first year of teaching. Since these teachers were assigned to a Special Services School, the type of help being studied was that needed by teachers in a Special Services School.

Procedures

The study centered upon eight first-year teachers of the 1956-1957 Graduate Program 891. Their experiences during the first year of teaching were studied in detail by analyzing questionnaire data, weekly logs, interviews, free response writing, and responses to an evaluative instrument. In addition the investigator observed in the classrooms and used records made available through the teachers of the study and from her own recordings. For comparative purposes the remainder of the 891 graduate program teachers were asked to respond to the questionnaire used in the study.

Findings

1. According to the perceptions of the eight first-year teachers, the seminar proved to be a useful method for trainees to continue their learning experiences. On the evaluative scale, Evaluation of Seminar Experiences, 67 per cent of the responses were designated as fairly useful, useful, or very useful. Teachers enrolled in the seminar, reduced their problems in severity and frequency 6 per cent from January to June. The major areas in which the problems decreased in importance were those which received concerted attention in the seminar. The seminar staff was designated by the group of first-year teachers as their major source of professional help in January and again in June.

2. Problems common (through the top one-third of the rank order) to both groups of first-year teachers in the study, were related to the task of working with groups of children or relating to individuals within a group, with the exception of the last one. These problems were:

Disciplining individual children
Relating follow-up work to independent reading
Keeping discipline in the classroom
Developing small work groups
Planning a well-balanced program of experiences

3. Experiences found valuable in their year's relationship with the University were:

Opportunity to be a member of a team teaching in one school
Visitations to children's homes
Developing actual plans for group work in each classroom
Helping to develop content of seminar sessions
Use of term projects to discover materials and resources one could use in his classroom

4. Three types of materials found most helpful to the eight first-year teachers were free, inexpensive material carefully selected so that it has eye appeal, records for music activities, and current, expendable materials such as magazines, papers, art supplies, ditto paper, scotch tape.

5. Administrative relationships needed to facilitate their teaching in a Special Services School were a continuous orientation program opportunity to help make decisions, and the need to be able to talk with someone interested in them. Microfilm $3.40; Xerox $11.60. 261 pages.

A CONCEPT ANALYSIS OF RECURRING WORDS IN FOURTH-GRADE READERS (VOLUMES ONE AND TWO)

(L. C. Card No. Mic 59-1102)

Dupont Guerry Harris, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Dr. Arville Wheeler

The purpose of this study was to determine the number of different concepts a child must acquire in order to be able to interpret accurately recurring words (nouns, verbs, adverbs, and adjectives) in fourth-grade readers which were widely used at the time the study was begun. Possessives, infinitives, gerunds, participles, verb phrases, proper names, hyphenated expressions, titles, abbreviations, contractions, the articles, forms of the verb "be," and such expressions as "my goodness," "adios," and "heehaw" were omitted.

Each word, the number of times it occurred on a page, its page reference and the context in which it occurred were written on a 5" x 8" card. This was done for each book which was given a code number. All cards were filed alphabetically and then serially by code number within the word. Webster's New International Dictionary of the English Language, Second Edition, Unabridged, published in 1955 was used in determining the meaning. A word having only one meaning in a book and no different meaning in any other book was not included. The words were listed and the meanings were written on a special form. Tabulation was made on this form of each meaning under its reader code.

From the tabulations were determined the number of words occurring in the readers, the number of different meanings in each reader, the total number of meanings of each word, the total number of frequencies of meanings, the average number of frequencies of meaning on a page, the average number of frequencies of meaning for each word in each book, the range of the total frequency of meaning, the number of times a word occurred only in one reader, the commonality of words in all the readers, the commonality of meaning to all the readers, the number of different meanings of each word in each reader, the total number of meanings of each of these words in each reader, the range of the number of different meanings, the medians of the number of different meanings, the range of the total number of meanings, the medians of the total number of meanings, and the words common to all readers.

Findings

The study reveals that there are 1,370 words with two or more meanings which occur in the six readers; the number of different meanings ranges from 1,480 to 2,872; the total number of frequencies of meaning ranges from 7,893 to 16,648; the average number of frequencies of meaning on a page ranges from 21.9 to 42.8; the average number of frequencies of meaning for each word in each book ranges from 10.6 to 16.5; the range of the number of different meanings is from 49 to 101; there are no planned repetitions of meanings; variant meanings of the same word occur in the same paragraph; many colloquial words are used; many meanings have low frequencies; many meanings have high frequencies; and no reader has a concept list.

Conclusions

The book with the greatest number of different frequencies of meaning is probably the most difficult to read, the difficulty of a meaning is not revealed by statistical analysis, variant meanings might confuse the reader, provision ought to be made by the authors and publishers for meaningful repetition of meanings, a pupil will need to have or to acquire concepts related to any of the material that he will read, the teachers should provide the necessary background of experience for the acquisition of these concepts, and these readers should contain concept lists.

A word was not tabulated if it did not have more than one "meaning" use in a given reader or a different "meaning" use in another reader. Webster's New International Dictionary of the English Language, Second Edition, Unabridged, published in 1955, was used in determining the meaning a word had in a particular context.

Findings

This study reveals that there are 1,370 words with two or more meanings which occur in one or more of the six readers. A tabulation was made of the frequencies of meanings. A study of the tabulated frequencies reveals that:

1. Of the 1,370 words the number of words occurring in each book is: Book I, 1,005; Book II, 1,075; Book III, 875; Book IV, 1,075; Book V, 864; Book VI, 740.
2. The average number of these words on a page of each book is: Book I, 2.3; Book II, 2.9; Book III, 2.3; Book IV, 2.5; Book V, 1.8; and Book VI, 2.0.
3. The total number of different meanings of all words is: Book I, 2,811; Book II, 2,872; Book III, 2,283; Book IV, 2,423; Book V, 1,734; and Book VI, 1,480.
4. The total number of the different frequencies of meanings of all words is: Book I, 16,648; Book II, 15,735; Book III, 12,807; Book IV, 13,090; Book V, 14,045; and Book VI, 7,893.
5. The average number of the different frequencies of meanings of all words on a page is: Book I, 39.7; Book II 42.8; Book III, 34.8; Book IV, 31.0; Book V, 31.1; Book VI, 21.9.
6. The average number of different frequencies of meaning for each word in each book is: Book I, 16.5; Book II, 14.6; Book III, 14.6; Book IV, 12.0; Book V, 16.2; and Book VI, 10.6.
7. The range of the number of totaled frequencies of concepts in the readers is from 7,893 in Book VI to 16,648 in Book I.
8. The total number of times a meaning occurs one time in only one of the readers is 2,745; the total number of times a meaning is common to only two of the readers is 1,122; the total number of times a meaning is common to only three of the readers is 564; the total number of times a meaning is common to only four of the readers is 444; the total number of times a meaning is common to only five of the readers is 357; and the total number of times a meaning is common to all of the readers is 417.

Microfilm $11.50; Xerox $41.00. 911 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

DOCTORAL CANDIDATES AT GEORGE PEABODY COLLEGE FOR TEACHERS FROM 1919-1950

(L. C. Card No. Mic 59-1104)

William Depew Hedges, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Erick L. Lindman

Characteristics of persons who were candidates for the Ph.D. at George Peabody College for Teachers between 1919 and 1950 were studied. Strengths and weaknesses of the doctoral program, as seen by the candidates, were examined. Positions which the candidates had attained and their contributions through research were ascertained. Reasons why some of the candidates did not graduate were explored.

It was hypothesized that there are factors which distinguish candidates who completed the requirements for the Ph.D. from candidates who did not.

Statistics used were chi square, tetrachoric r, rank order correlation, and per cent.

Recommendations were made for selection of doctoral candidates and for modification of the doctoral program at Peabody College.

Sources of data were Peabody College records and 456 answers to a questionnaire. Of those who responded, 325 had earned the Ph.D.; 131 had not. Graduates for every year from 1919 through 1950 were represented in the returns.

Factors which distinguished the Ph.D. group from the non-Ph.D. group were: (1) age at college graduation, (2) occupations of mothers, (3) sex, (4) college rank, (5) correlation between high school and college rank, and (6) college grade average.

There was disagreement between the groups with respect to certain problems. These were: (1) the master's thesis as a requirement, (2) guidance in selection of a dissertation topic, (3) emphasis on research and practice in Ph.D. and Ed.D. doctoral programs, and (4) the purpose and value of the oral examination.

There was basic agreement between the groups with respect to the following: (1) content and standards for the doctorate, (2) nature and amount of guidance, (3) cooperative research, (4) the most important characteristic of the dissertation, (5) internships, (6) most valuable courses, (7) attributes of professors, (8) reasons for selecting Peabody College for advanced graduate work, (9) recruitment procedures, and (10) screening.

Over two-thirds of Peabody College's Ph.D.'s were holding professorial rank. Almost one-half were professors of education, English, psychology, and mathematics. Over one-half of the other group were in public school work, professors of education, self-employed, or in state departments of education.

Little research had been accomplished by either group. The majority had not written a book. About 40 per cent had not written an article. A few were prolific writers.

Most of Peabody's advanced graduates came from and returned to a few of the southern states.

Major reasons given by 131 candidates for not completing the degree were: (1) time and money were not warranted by the candidate's position, (2) financial difficulties, (3) too busy, and (4) personal or family illness.

Recommendations made were:

1. Periodic follow-up of graduates
2. Improved selection procedures
3. Earlier identification of doctoral material
4. Acceleration of doctoral programs
5. Strengthened and expanded guidance program
6. Protection of candidate from a weak dissertation topic
7. Increased emphasis on cooperative research
8. Re-examination of the role of research experiences in preparation programs
9. Equal emphasis on research and practice in Ed.D. and Ph.D. degree programs
10. Flexible programming
11. Re-study of the purpose and conduct of the oral examination
12. Increased emphasis on field learning experiences
13. Selection of faculty
14. Broadening and expansion of the recruitment and placement programs
15. Study of why certain courses were felt to be more valuable in later work
16. Development and refinement of screening devices
17. Clarification of the role of the Peabody Ph.D. and tailoring of the preparation program in the light of the objectives established.

Microfilm $4.55; Xerox $15.20. 355 pages.

EVALUATION IN INDUSTRIAL ARTS TEACHER EDUCATION

(L. C. Card No. Mic 59-1360)

H. L. Helton, Ed.D.
Wayne State University, 1958

Adviser: G. Harold Silvius

The Problem

The purpose of this study was to develop an evaluation instrument consisting of standards and criteria for the accreditation of undergraduate industrial arts teacher education programs. As early as 1950 national agencies concerned with accreditation of teacher education had expressed a need for such materials to facilitate their accrediting activities. When the National Council for Accreditation of Teacher Education assumed accrediting responsibilities from the American Association of Colleges for Teacher Education, the industrial arts profession was asked to prepare and send to the National Council for Accreditation of Teacher Education an evaluation instrument for industrial arts teacher education.

In addition, standards and criteria for undergraduate industrial arts teacher education were desired by members of the industrial arts teacher education profession to provide a basis for study and appraisal of their individual programs. To produce an instrument to meet these needs was the significant objective of the research.

Development of the Instrument

An opinionaire, developed through review of literature pertinent to industrial arts, was sent to the departmental

chairman of 202 institutions reported to have programs of industrial arts teacher education. Chairmen were asked to rate characteristics of programs of industrial arts teacher education as either: (1) essential, (2) desirable, (3) acceptable, (4) undesirable, or (5) detrimental. After return of 82 per cent of the opinionaires, characteristics rated either essential or desirable by at least 75 per cent of the respondents were selected, grouped, and written as tentative standards and criteria for efficient programs of industrial arts teacher education.

The tentative standards and criteria were then arranged in the form of an evaluation instrument and submitted to the National Committee on Accreditation of Industrial Arts Teacher Education Programs, a committee established at the request of the National Council for Accreditation of Teacher Education, and to the Evaluation Committee of the National Association of Industrial Teacher Educators for review and further development. The suggestions from members of the two committees for improving this instrument were incorporated before it was sent to the National Council for Accreditation of Teacher Education.

Reaction of the National Council for Accreditation of Teacher Education

After reviewing instruments submitted by industrial arts and seven other specialized groups in teacher education, the National Council for Accreditation of Teacher Education announced these four policy decisions affecting further development of evaluation materials:

1. The official Standards used by the National Council for Accreditation of Teacher Education would be revised to make their application to specialized areas of teacher education as pertinent and complete as possible.
2. Supplements to the National Council for Accreditation of Teacher Education Guide would be used to facilitate evaluations of specialized areas.
3. Supplements to the Guide should be developed by the specialized areas and designed to request information to help determine whether the NCATE Standards were being met.
4. Specialized groups in teacher education were encouraged to develop evaluation instruments for use in upgrading programs in their areas.

Supplementary Guide for Industrial Arts

The supplementary guide requested by the National Council for Accreditation of Teacher Education for accreditation of industrial arts was then prepared and sent to the National Committee on Accreditation of Industrial Arts Teacher Education Programs for evaluation. Comments received from committee members were incorporated in a refined copy of the supplement which was then presented to W. Earl Armstrong, Director of the National Council for Accreditation of Teacher Education.

Publication of the Instrument and Supplement

To report progress in accreditation of industrial arts teacher education and describe their participation in the development of the evaluation instrument developed through this study, the National Committee on Accreditation of Industrial Arts Teacher Education Programs proposed to prepare the seventh yearbook for the American Council on Industrial Arts Teacher Education. The evaluation materials developed through this study were included as an integral part of the yearbook which was scheduled for presentation to the American Council on Industrial Arts Teacher Education during the annual convention in Boston, April 29 to May 2, 1958. Microfilm $3.75; Xerox $12.80. 291 pages.

SPATIAL REQUIREMENTS FOR A FARM MECHANICS LABORATORY

(L. C. Card No. Mic 59-1270)

Harry Danner Henderson, Ph.D.
University of Minnesota, 1958

Adviser: Milo J. Peterson

Purposes

1. To devise a method of studying subjects and their actions within a selected time limit at the various work stations in a farm mechanics laboratory. The data recorded must show, within reasonable accuracy, the action limits of each operation performed.
2. To formulate minimum and optimum space recommendations for each of the common work stations in a teacher training farm shop laboratory.

Procedures

The population for the spatial study was comprised of students majoring in agricultural education at the Wisconsin State College, Platteville, Wisconsin. Members of farm mechanics, farm carpentry, farm machinery, and farm power classes were used. Body dimensions of the subjects were compared with those in a study conducted by Lloyd Sahley[1] in order to discover if the subjects anatomically represented a normal segment of the total population.

The data for the spatial study were obtained from grid sheets containing floor plans of 13 work stations which were located in the teacher training farm shop at the Wisconsin State College, Platteville. The work stations included were as follows: arc welder, bench and vise, drill press, forge and anvil, grinder-buffer, jointer, machinery repair, oxyacetylene welder, radial saw, round table, soldering bench, table saw, tool grinder. Theoretical standards were established to serve as guides in marking the operational areas at the work stations, and to facilitate the tabulation of the data. A grid system consisting of rows of six inch squares taped on the floor in the operational area at each machine or work bench were used to trace movements of the subjects. An observer recorded the extremities of motion at each work station on the grid or data sheet. The method of measuring operating space was validated by comparing the instrument with two other methods: memo-motion pictures and the McCullough[2] technique (movable panel placed next to the subject). The three means of mensuration were summarized for analysis by the Latin square method. The F test showed that there were no significant differences among the methods of

measurement. Since the results were also consistent for every machine station at which the subjects worked, the instrument was considered valid and reliable.

The experimental data were recorded during laboratory sections of the above mentioned classes. Dimensions to the left, to the right, and to the rear at each work station were recorded. The zero point for each measurement was the center of the front of the work station. Composite data sheets showing all the outlines at each work station were formed by transposing all the individual outlines onto one sheet. The resulting pattern indicated the extremes of motions, the greatest concentration of space use, and the variations among individuals. From a dimensional analysis the median, mean, standard deviation, and range for each measurement were computed.

Findings and Conclusions

The dimensional analysis and the composite data sheets were used as the basis for determining space recommendations for each of the work stations. Minimum and optimum standards were developed. The study indicates that the space requirements at a work station depend on the following factors:

1. The work element performed at the station.
2. The size of the material on which the work element is performed.
3. The anatomical dimensions of the worker.
4. The working habits of the individual.
5. The number of people using a station at one time.

Microfilm $2.35; Xerox $8.20. 177 pages.

1. Sahley, Lloyd W., Body Dimensions of the Human Figure, Cleveland Designers & Consultants, Inc., Cleveland, Ohio, 1957.

2. McCullough, Helen E., A Preliminary Report on Space Requirements for the Home Laundry, Journal of Home Economics, Vol. 44, No. 6, June, 1952.

IMPROVING RELATIONSHIPS THROUGH IN-SERVICE EDUCATION: A STUDY OF THE EFFECTIVENESS OF THE PRE-SCHOOL PLANNING CONFERENCE OF A COUNTY SCHOOL SYSTEM IN MOTIVATING A PROGRAM TO IMPROVE RELATIONSHIPS

(L. C. Card No. Mic 59-1058)

Julius Barney Hodges, Ed.D.
New York University, 1958

Chairman: Professor Louis E. Raths

The problem of the study is:

> . . . to evaluate the effectiveness of the pre-school planning conference of a county school system in motivating in-service education activities, to improve relationships, in the different schools.

The setting of the study is the in-service education program of 1,500 members of the professional staff, in 102 schools, of the School District of Greenville County, South Carolina. The district, formed in 1951, developed an in-service program characterized by a high level of staff participation and by use of a pre-school conference to motivate professional growth activities in all schools. The 1956-1957 program, with which the problem deals directly, had as its goal the improvement of relationships.

The investigator sought answers to two questions:

1. Was staff participation such that the pre-school conference was judged effective?
2. Did the different faculty groups carry out, in their local in-service programs, activities related to the purpose of the pre-school conference?

Evidence relating to the two questions was obtained from three sources: (1) an opinionnaire in which staff judged the effectiveness of pre-planning and all phases of the pre-school conference; (2) in-service record booklets, submitted by each faculty, containing lists of activities planned and carried out during the year; and (3) an opinionnaire in which staff judged the extent to which activities planned in the pre-school conference were carried out in the school programs, and the extent to which relationships were improved in each of four broad areas selected for emphasis in the program.

Means of appraisals were calculated for the total personnel group and staff sub-groups in terms of job function, experience, and other variables. Rankings of appraisals of the sub-groups were compared. Means were found to be consistently high and rankings of sub-groups' appraisals similar with reference to effectiveness of the pre-school conference and positive changes in relationships.

Analysis of the reports of in-service activities of the faculty groups showed very active, and highly variable programs to improve relationships in the different schools. Staff judged that activities planned in the pre-school conference were, in general, carried out.

Evidence obtained from the different sources was found to be remarkably consistent. It pointed to enthusiastic acceptance of the responsibilities involved in staff participation in planning and executing the in-service program, individual and faculty group adoption of its purposes, and a sense of accomplishment, as staff directed efforts toward the attainment of those purposes.

Since the staff judged themselves successful in working toward the goals they had formulated through cooperative planning of the program, an assumption that the needs of the staff, as expressed through these goals, were met seems justified.

The setting of the study is distinctive in that (1) staff had the opportunity to develop an in-service program in a new district; (2) administrators and teachers evidenced a high degree of commitment to the principles of democratic participation; and (3) the quality of participation and the relationship of the pre-school conference to the programs in the different schools resulted in an unusually high level of individual and faculty group motivation for change.

Evidence of the study pointed to (1) the need for intensive, and separate, study of the nature of participation of high school personnel; (2) the value of broad staff participation; (3) the importance of continued searching for new and better ways of promoting professional growth in the system; (4) the effectiveness in motivating programs in the local schools, of (a) participation, (b) the pre-school

conference, and (c) a relatively high degree of local autonomy. Microfilm $5.45; Xerox $19.20. 426 pages.

DEVELOPMENT, ORGANIZATION, AND ADMINISTRATION OF STUDENT TEACHING IN SOUTH CAROLINA

(L. C. Card No. Mic 59-1105)

Jones Calvin Koonts, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Clifton L. Hall

Problem

The purpose of this study was to present a descriptive account of the development, organization, and administration of student teaching in South Carolina. A survey was conducted among the twenty-one colleges and universities offering student teaching, comparisons were made with national trends and practices, and recommendations were offered.

Procedure

Information relative to the development of student teaching was obtained from newspaper accounts and documentary sources. An interview was held with the director of student teaching or academic dean of each college to determine organizational and administrative practices during the 1956-1957 academic year, and a questionnaire was completed by the representative at the time of the interview. A study of the literature in the field of student teaching and an analysis of the curricular content of college catalogues were made. The relative importance of student teaching was determined by an opinionnaire mailed to forty selected educational authorities who have influenced teacher education in South Carolina.

Findings

Although there has been some type of student teaching in South Carolina since 1859, it was not until 1945 that the course was made compulsory for every prospective teacher by the State Department of Education. The twenty-one institutions offering the course may be classified as private, state-supported, and municipal colleges. Sixteen institutions are for white students and five are for Negro students. All these colleges offer off-campus student teaching; only three offer on-campus teaching.

The typical cooperating teacher in South Carolina holds the bachelor's degree, is certified by the State Department of Education, and has passed the National Teacher Examination. There is no state-wide policy concerning remuneration to the cooperating teacher, but subsidies are given and special privileges are afforded these teachers by the institutions offering student teaching.

The typical student teacher in South Carolina is a college senior with a scholastic average of C and who has been approved for teaching by a faculty committee on teacher education. The student has earned a prescribed number of credits in general and professional education before enrolling for the course.

The length of the course is customarily one semester. Six weeks is the average duration of the training period, and the majority of the colleges specify that ninety clock hours be spent in observation, participation, and actual teaching.

It is customary that joint control between the college and the cooperating school be exercised in the administration of student teaching. There is joint supervision and evaluation of student teaching. The conference is reported as essential in the evaluative process, and there is general agreement that the cooperating teacher's evaluation of the student teacher's work is the most important single determinant of the student's final mark on the course.

Recommendations

A comparison of South Carolina findings with national trends and practices reported by the American Association of Colleges for Teacher Education and the Association for Student Teaching was one of the principal bases for the recommendations. The suggested improvements included more professional laboratory experiences before and after student teaching, written agreements between the college and the officials of the cooperating schools, supervision by the academic as well as the professional personnel of the college, and after-graduation follow-up of student teachers. The desirability of approval of all colleges by the National Council for Accreditation of Teacher Education was also emphasized.

Microfilm $5.45; Xerox $19.20. 427 pages.

A CASE STUDY IN TEACHER EDUCATION

(L. C. Card No. Mic 59-1363)

Richard Edward Lloyd, Ed.D.
Wayne State University, 1958

Adviser: Ole Sand

What Was The Problem? . . . Because many educators were searching for possible answers to the current teacher shortage, the writer decided to make a detailed study of eighteen students who were enrolled in the Post Degree Teacher Certification Program at Wayne State University. The purpose of the study was to analyze one group of learners who were participating in this program with particular attention to an evaluation of the learning experiences of these students during their pre-service program and their first semester on the job. Tentative conclusions were drawn as to the factors to which the success or lack of success of the program could be attributed.

To achieve the purpose of the project seven questions were identified:

1. What are the characteristics of the total P.D.T.C.P.?
2. What were the characteristics of the eighteen students who were enrolled in this program for the second semester 1956-57?
3. What did these students need to learn in the P.D.T.C.P.?
4. What learning experiences were selected for these students and how were they organized?

5. How effective were these learning experiences and what did the students learn?

6. What were the writer's and the students' perceptions of the students' effectiveness on the job during their first semester of teaching?

7. What hypotheses emerged from an analysis of this program that could be tested in the future?

How Were Data Gathered For This Project? . . . Personal data regarding the students under study were gathered from cumulative records, personal data sheets, and interviews with the students. Interviews, observations, student logs, and student evaluations of class sessions were used to continually evaluate the effectiveness and the organization of learning experiences.

Observations by the investigator, responses to questionnaires, and interviews with students and principals who employed these students were used to determine the students' effectiveness on the job during their first semester of teaching.

What Methodology Was Used In This Project? . . . A case-method approach was used in this project. The P.D.T.C.P. as a means of preparing prospective teachers was identified as a unit of attention. A historical review of the program, a description of the students, and a description of the learning experiences provided revealed the status of the phenomenon under study. Observations, oral responses and reaction of learners in seminar sessions, and interviews with students enabled diagnosis and identification of causal factors. The fact that one instructor supervised the students and taught the seminar sessions enabled the instructor to determine the progress of each student. Continuous reassessment of student progress in student-teaching situations and visitations to determine the students' effectiveness during their first semester of teaching completed the case-method cycle.

What Conclusions Were Inferred From This Study? . . . The completion of this study resulted in the following conclusions:

1. Students with a strong background of liberal education were successfully prepared as teachers through an intensified program of teacher education.
2. Proliferation of required professional courses can be eliminated in a program of this type.
3. The program enabled the integration of theory and practice. It provided an assessment of whether students could apply professional knowledges and skills in practical classroom situations.
4. The organization of the program contributed to the selection of learning experiences which enabled students to learn what they need to learn in order to become successful teachers.
5. A program in which a close, personal relationship exists between the instructor and students contributes to provision for individuality.
6. The program provides a new source of teachers to meet the current teacher shortage.
7. No evidence exists which indicates that the program could not be successful with undergraduate students.
8. Experiences with children in the student-teaching situation make the greatest contribution to the students' professional preparation.

Microfilm $3.55; Xerox $12.20. 276 pages.

A COMPARISON OF STUDENTS AT MIDDLE TENNESSEE STATE COLLEGE WHO CHOOSE TEACHING AS A CAREER WITH STUDENTS WHO CHOOSE OTHER CAREERS

(L. C. Card No. Mic 59-1109)

James Aquila Martin, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Harold D. Drummond

The purpose of this study was to compare two groups of students at Middle Tennessee State College, one of the state supported teacher training institutions. One group of students was made up of one hundred individuals who chose teaching as a career while the other group consisted of a like number who chose other careers. Both groups were randomly chosen from students of the College who were classified as sophomores. Comparison was made of the general intelligence, personality adjustment, and attitudes concerning teaching situations, of the two groups, as measured by standardized tests or inventories. Achievement in college course work, participation in college activities, home environment, teacher opinions of the particular student and other information elicited in interviews with the writer were considered as the groups were compared.

The hypothesis tested was: There is no significant difference between students who choose teaching as a career and students who do not choose teaching as a career at Middle Tennessee State College, as shown by scores on the Otis Self Administering Test of Mental Ability, the Cornell Index, and the Minnesota Teacher Attitude Inventory and as determined by pertinent case history material.

Findings of the Study

The data obtained from the administration of the three tests previously mentioned were submitted to two tests of significance at the 5 per cent level of confidence. The results of "Student's t" test and the F, or variance ratio, test sustained the null hypothesis with respect to all three factors or characteristics tested. The group choosing teaching was slightly inferior to the group not choosing teaching, with respect to general intelligence, but the difference was not significant. The group choosing teaching was slightly superior to the group not choosing teaching, with respect to personality adjustment, but the difference was not significant. The group choosing teaching was slightly inferior to the group not choosing teaching, with respect to attitudes concerning teaching situations, but the difference was not significant.

The information obtained in interviews with the writer was tested for significance, when this was possible, using the F, or variance ratio, test at the 5 per cent level of confidence. These tests further sustained the null hypothesis. It was found that the group choosing teaching was slightly inferior, to the group not choosing teaching, in

grades made in course work of the major field of study. The two groups were equal with respect to grades in general education courses required of all students. There was also equality in the average family-size of both groups. The mothers of those choosing teaching had a slightly higher educational attainment than the mothers of those not choosing teaching, but the fathers of the group choosing teaching had a slightly lower educational attainment than the fathers of those not choosing teaching. The fathers of both groups were, for the most part, skilled craftsmen.

In view of these findings it can be concluded that there is no significant difference between students who choose teaching as a career and students who do not choose teaching as a career, at Middle Tennessee State College, as shown by scores on the Otis Self Administering Test of Mental Ability, the Cornell Index, and the Minnesota Teacher Attitude Inventory and as determined by pertinent case history material. Microfilm $2.00; Xerox $4.40. 85 pages.

SUPERVISORY CONFERENCES IN STUDENT TEACHING IN CAMPUS ELEMENTARY SCHOOLS

(L. C. Card No. Mic 59-775)

Mary Alice Smith, Ed.D.
The Pennsylvania State University, 1958

THE PROBLEM

This study was conducted to find important characteristics of conferences between supervising teacher and student teacher in the student teaching program. The problem was; What are important characteristics of method and content in supervisory conferences which make them of value to the student teacher? In order to answer this problem the following subordinated problems were formulated: (1) What does the literature in the field suggest for conferences? (2) What do supervisors and student teachers consider important characteristics of method and content in supervisory conferences? (3) How frequently are classroom teaching problems discussed in conferences? (4) How adequate are the discussions on classroom teaching problems? (5) What conclusions can be derived from the study which may be used for the improvement of supervisory conferences? (6) What are the implications for teacher education?

THE PROCEDURES

After the literature was reviewed, two opinionnaires were constructed. One opinionnaire was for supervisors and one was for student teachers. A pilot study was conducted at Lock Haven State Teachers College to try out the opinionnaires. A variety of conferences was tape-recorded; the reactions to two of the tape-recordings, of a group of graduate students at The Pennsylvania State University, were tabulated. After a revision of the opinionnaires, data were collected from eighty-one student teachers and twenty-seven supervisors at three other State Teachers Colleges. The results were tabulated; conclusions and recommendations were formulated.

CONCLUSIONS

This study showed that there was much agreement between student teachers and supervisors as to the high importance of certain classroom teaching problems. Both believed that: (1) Evaluation of Children's Learning and Development; (2) Evaluation of Student Teacher's Growth; and (3) Discussion of Individual Children were of utmost importance. At least eighty per cent agreed that these problems were essential. Half or more of both groups agreed that it was also essential that the following problems be discussed: (1) Explanation of Routine Procedures; (2) Group Processes in the Classroom; and (3) Discussion about Methods and Study Plans.

Supervisory conferences need to have the following characteristics: (1) Establishing Rapport with the Student; (2) Beginning on a Positive Note; (3) Ending on a Positive Note; (4) Freedom from Interruptions; (5) An Open Mind on the Part of the Supervisor; and (6) Consistency of the Supervisor.

Throughout the pilot study, the reactions to the tape-recordings, and the answers on the opinionnaires, there was much agreement of the value of conferences in teacher education.

IMPLICATIONS

A check list of important classroom teaching problems which need to be discussed should be helpful to supervisors for other than research purposes.

It may be useful for the State Teachers Colleges of Pennsylvania to develop cooperatively a check sheet for a guide to conferences.

Institutions preparing prospective college teachers and supervisors should include counseling courses as part of the program.

Courses in the Supervision of Student Teaching should include a section on conferences.

Supervisors might study their own conferences. The tape-recorder and the opinionnaires are useful instruments which could help them to improve their methods and techniques in conferences as well as to check on the content of their conferences.

Microfilm $2.20; Xerox $7.60. 165 pages.

THE COMPETENCES OF SECONDARY SCHOOL SCIENCE TEACHERS

(L. C. Card No. Mic 59-1429)

Leroy Spore, Ed.D.
Stanford University, 1959

Supervisor: Paul deH. Hurd

The purpose of this research was to identify the professional competences of science teachers, where the emphasis on each competence should be placed in the training program, the criteria that should be used in the selection of science teachers, and to determine if the four groups of judges are in agreement in their perception of the role of the science teacher.

Procedure

The sixty competences, selected as those abilities needed by secondary science teachers, represented the expressed opinions of writers in the literature of science education. When placed in the rating form the competences were organized under the six roles as appear in "The California Definition of Teacher Competence."

The groups of judges were: I - Foundations Educators, II - Science Educators, III - Science Teachers, IV - Administrators. A five point scale was devised for use in rating the competences. The rating instrument provided a place for the judges to indicate where they believed the emphasis in training should be placed for the competences considered important.

Limitations

This research through the opinions as expressed by the judges has attempted to answer questions pertinent to teacher education. In interpreting the findings it should be noted that they are based on the opinions of competent judges and not on empirically validated statements. It is intended that the information gathered should be valuable in the structuring of the training program for secondary science teachers, and not necessarily for the perfection of the individual teacher.

Findings

The foundations educators by the standard deviation of the distribution of ratings from the mean were the least consistent and the administrators the most consistent in their ratings.

The "t" test showed a high level of significance in most of the cases where there was a considerable difference of opinion.

In determining the amount of agreement among the judges the coefficient of correlation between the science teachers and administrators was found to be .94, foundations educators and teachers and administrators .85, science educators and administrators .87. The lowest correlation was between the foundations educators and science educators with a .68.

By the Chi Square test on the data of where the judges believed the emphasis of training should be placed it was found that the null hypothesis had no validity in any case.

Conclusions

To answer the question of what competences science teachers need the competences according to the judgment of each rating group were presented in rank order. Also presented were the thirty highest ranked competences according to the combined judgment of all four groups of judges.

From the findings of this study in general the four groups of judges perceive the role of the science teacher the same with some significant differences concerning specific items.

In placing emphasis in the training program the judges were of the opinion, with some exceptions, that for most of the competences equal emphasis should be given in preservice and in in-service training.

The list of competences given as needed by the science teacher should help in establishing criteria for the selection and evaluation of science teachers.

There is evidence revealed in this research that the foundations educators perceive the role of the science teacher, in certain respects, quite differently than the science educators. Research is needed on why the different groups used in this study rate the importance of several of the competences differently. This should be of concern to those whose job it is to direct and coordinate training programs for science teachers.

Microfilm $2.00; Xerox $5.80. 119 pages.

A STUDY OF CERTAIN ASPECTS OF ELEMENTARY STUDENT TEACHING EXPERIENCES AND SUPERVISION IN THE PROGRAM OF TEACHER EDUCATION AT THE CITY COLLEGE OF THE CITY OF NEW YORK

(L. C. Card No. Mic 59-1040)

Lilian L. Stevens, Ed.D.
New York University, 1958

Chairman: Professor Alonzo F. Myers

The purpose of this study was to point the way toward improving the insights and activities of those engaged in the supervision of student teaching at the elementary level at The City College of New York by evaluating certain aspects of the Student Teaching Program.

First, the criteria undergirding a valid program of student teaching and supervision were determined from recommendations of professional educational organizations and from principles advocated by educational leaders. Much of the data was secured from yearbooks of the following professional organizations: American Association of Colleges for Teacher Education; American Council on Education; Association for Supervision and Curriculum Development; and, particularly, the Association for Student Teaching.

Trends discussed in these sources were classified according to the several aspects of the program with which they dealt: "the philosophy and ways of working inherent in a democracy," "opportunities for student teachers to understand the total role of the teacher," etc., and a total of nineteen Criteria resulted.

Second, through the use of a comprehensive scale for evaluating competencies, the effectiveness of the Student Teaching Program in developing major competencies in elementary teaching was determined.

The scale needed to be appropriate for self-appraisal by student teachers and for evaluation of students by the supervisors. An abbreviated form of the California Statement of Teaching Competence was chosen. The full form appeared in the 1949 Yearbook of the Association for Student Teaching and includes most of the items emphasized in the literature reviewed. In abbreviated form it was a practical instrument for The City College supervisors, clear enough for self-evaluation by the student, and encompassed the major emphases.

The third problem was to determine the supervisors' emphases as revealed in their written reports to student teachers, and to relate these to the Criteria. The material recorded in 200 reports under "Supervisor's Comments

and Recommendations" was classified under headings such as motivations, activities, etc., and the number of comments under each counted. The totals established emphases in the supervisors' reports, and a comparison with relevant Criteria was made.

The final problem was to determine the effectiveness of the student teaching experience as revealed through student teachers' responses to the 7 questions of the Questionnaire "Student Evaluation of Student Teaching Experience," adapted from the 1951 Yearbook of the Association of Student Teaching. Specific information on the range of experiences: responsibilities aside from classroom teaching, opportunities to utilize own ideas in carrying out responsibilities, etc., was requested, as well as the student teachers' reaction to them. Relationships between students' responses and the areas of competence and the Criteria were analyzed.

Among the conclusions and implications in this study were:

1. Infrequent comment by supervisors on democratic ways of working and mental hygiene indicates a need for more attention to these areas by those working with student teachers.

2. Since professional literature stresses the important role of the cooperating teacher, it is recommended that the selection of these teachers be a partial responsibility of the City College Administration.

3. Need was revealed for more careful selection of schools and situations for student teachers, more opportunities for participation in the teacher's total role, freedom from onerous clerical duties, and continuous periods of teaching in which content areas can be planned and developed with children.

4. More direct experiences with the children and the creative use of such experiences is needed.

5. Student teachers desire more guidance from principals, cooperating teachers, and supervisors, joint conferencing and more intensive supervision and more specific guidance from the College supervisors. It is recommended that the Administration endeavor to provide more time for these activities.

6. It is recommended that students be released from afternoon classes in order to attend curriculum meetings and conferences with parents and to acquaint themselves with community resources. Many student teachers desired a full year of student teaching.

Microfilm $5.65; Xerox $19.80. 444 pages.

EDUCATION, THEORY AND PRACTICE

THE EFFECT ON SELECTED SCIENCE EDUCATION OBJECTIVES OF A SOUND MOTION PICTURE WITH ACCOMPANYING CLASSROOM TEACHING UNIT CONCERNING POLIOMYELITIS PRESENTED TO HIGH SCHOOL STUDENTS

(L. C. Card No. Mic 59-1010)

David L. Bichler, Ph.D.
New York University, 1958

Chairman: Professor J. D. Barnard

The purpose of this investigation was to study the effectiveness of an audio-visual aid in the attainment of selected objectives in science education. More specifically, it was to study the gain in information regarding the progress of medical research against poliomyelitis; to measure the change in the understanding of the biological principles concerned with the teaching unit on poliomyelitis used in this study; to measure the changes in attitude of the students towards the National Foundation of Infantile Paralysis; and to measure the change in attitude of the students towards the March of Dimes.

The classroom teacher has many sources of audio-visual instructional materials available from the voluntary public health agencies. An evaluation under practical classroom conditions is of prime importance to the teacher especially since there is usually no formal test or evaluation made on the majority of these materials by the sponsors and producers.

The data were obtained through the cooperation of three schools in different areas of New Jersey. The 292 students who participated in this study were either high school biology students or junior high school general science students in the ninth and tenth grades.

For the testing of the understanding of biological principles and biology achievement, tests devised by the investigator were constructed based on the polio teaching unit materials. Pilot studies constructed by the investigator indicated the reliability of the test items were sufficiently high for their intended use in this research.

The attitude scales used for measuring the students' "before-and-after" attitudes were Remmers Generalized Attitude Scales obtained from the Purdue Research Foundation. These standardized scales specifically measured attitudes towards institutions and practices.

For comparison all the groups were equated on the basis of their I. Q., Reading Ability, and Chronological Age. These cognitive variables were statistically treated and their relationship to pre-test results was interpreted. Some of these results were:

1) There is no statistically significant relationship demonstrated between Chronological Age of these students and their performance on the biology achievement and biological principles tests.

2) A knowledge of the intelligence of an adolescent gives no indication of his attitudes towards the National Foundation of Infantile Paralysis and the March of Dimes.

3) A knowledge of the Reading Ability of an adolescent gives no indication of his attitudes towards the National Foundation of Infantile Paralysis.

4) The older a child becomes, the less favorably he is inclined towards the National Foundation of Infantile Paralysis. This was not found to be the case with respect to the relationship between Chronological Age and the practices of the National Foundation of Infantile Paralysis (March of Dimes). A child's age has no significant bearing on his attitude toward the March of Dimes.

5) The criteria of I. Q. and Reading Ability for equating groups to be used in attitude studies such as these under investigation herein were not ideal.

6) The film "Interim Report" alone had little or negligible effect on the gains achieved on the biology achievement test.

Some conclusions drawn from this study are:

1) An audio-visual teaching unit on poliomyelitis will change the biology achievement of pupils in a statistically significant positive direction when a sound motion picture film is employed in the teaching unit.

2) An audio-visual teaching unit on poliomyelitis will not change the understanding of the biological by students in any statistically significant direction when a sound motion picture film is employed in the teaching unit.

3) A teaching unit which is related to a real-life problem of the individual or community and employs an audio-visual aid will not result in any greater statistically significant attitude change towards the voluntary public health agency, National Foundation of Infantile Paralysis, and the practice, March of Dimes, than a teaching unit not employing such an aid.

Further research on the evaluation of audio-visual materials is recommended with producers and educational institutions carefully evaluating their existing materials before classroom use.

Microfilm $2.20; Xerox $7.80. 166 pages.

A STUDY OF CHARACTERISTICS OF SELECTED EIGHTH GRADE PUPILS IN RELATION TO DIFFERENCES BETWEEN EDUCATIONAL ACHIEVEMENT AS MEASURED BY STANDARDIZED TESTS AND ACADEMIC SUCCESS AS INDICATED BY SCHOOL MARKS

(L. C. Card No. Mic 59-1215)

Aurlo Arthur Bonney, Ed.D.
University of Washington, 1958

Supervisor: Dr. Sylvia Vopni

The two groups compared in this study were selected from 587 eighth grade pupils at James Madison Junior High School in Seattle, Washington during the school year 1956-57, upon the basis of the degree of difference between their educational achievement as determined by scores on a battery of standardized tests and their academic success as determined by school marks assigned by teachers of the seventh grade for the academic subjects. Group A included those whose standardized test scores significantly surpassed their grade point average for academic subjects in the seventh grade. The location of a pupil's score in the distribution of average scores on the standardized tests for the eighth grade class was compared with the location of his grade point average in the class distribution of grade point averages computed from marks assigned for seventh grade academic subjects. If the pupil ranked at least 1.25 standard deviations higher in the test distribution than in the mark distribution he was included in group A. If the standing in the class distribution for marks exceeded the standing in the distribution of achievement test scores by at least 1.25 standard deviations, the pupil was included in Group B, that group whose marks significantly surpassed test scores. This study compared characteristics of groups A and B with regard to personal academic aspirations, concept of parental expectations, degree of participation in school activities, concerns about peer relationships, involvement in community activities, and ratings by teachers of observed qualities associated with level of effort and type of citizenship displayed.

Several instruments were used to collect information. The Stanford Achievement Test Battery, Advanced Form KM, was used to determine the educational achievement. Academic success was determined by the grade point average of marks received by pupils in language arts, social studies, mathematics, and science when the pupils were in the seventh grade. A rating form was used to obtain teacher judgments of pupils' personality characteristics. Separate questionnaires were used to obtain pupil reactions and also to determine the factors upon which teachers at James Madison Junior High School believed they assigned marks. The use of six components for marking varied from teacher to teacher and according to the ability the pupil was thought to possess.

Members of group B, those whose grade point average exceeded expectation as indicated by scores on achievement tests, exhibited a variety of characteristics. They were not social isolates; they joined church-affiliated organizations and performed in school extracurricular activities to a marked extent. Teachers rated them high upon all qualities. These pupils envisioned their parents as the type who supported but did not dominate their offsprings' choices and decisions. They believed they were performing at a level consistent with school marks received and parental expectations. Developing satisfactory peer relationships appeared to be their major concern. It was seen as being more important than and separate from that of maintaining a high level of marks in school subjects.

Group A members, those whose achievement tests indicated a mastery not shown in school marks, exhibited characteristics both enhancing and deterring possible success in school. They participated in scouting organizations but did not participate in extra-school activities. They believed their parents wished them to perform so as to receive high marks but did not believe they were putting forth the effort necessary to satisfy their parents. They stated that there was a direct relationship between peer popularity and high marks in school subjects and that high marks were more important than popularity with peers. They were absent from school twice as often as members

of the other group in spite of these statements. Though they said they were relatively well-satisfied with their social adjustment to peers, teachers rated them as possessing personality defects.

The identification of those pupils whose achievement on tests exceeded their level of marks in school subjects and an understanding of their characteristics were the preliminary steps to a more effective educational program.

Microfilm $3.55; Xerox $12.00. 273 pages.

RELATIONSHIP OF PRACTICES IN BUSINESS EDUCATION TO ESTABLISHED OBJECTIVES

(L. C. Card No. Mic 59-750)

Eleanor B. Brown, Ed.D.
The Pennsylvania State University, 1958

The problem of the study was to obtain from leaders in business education a reaffirmation of opinion on major issues and to ascertain the divergence of practices from objectives derived from the opinions.

The purpose of the study was (1) to establish important objectives in business education in secondary schools from 1950 to 1957; (2) to determine, in terms of the established objectives, the practices from 1950 to 1957; (3) to determine the relationship between the practices and the objectives; and (4) to make recommendations based on the findings.

The objectives were established by deriving them from a 1957 reaffirmation of the opinion of leaders which Hayden* had obtained in 1950 on the sixty-eight major issues he had identified. An opinionnaire containing Hayden's issues was used to obtain the opinions of the 1957 leaders. Two hundred nineteen leaders throughout the United States were requested to participate. Ninety-five per cent (207) responded.

The two sets of response were analyzed (1) by comparing the number and percentage of the 1950 and 1957 response to each issue; (2) by determining the statistical significance of the differences in the opinion by applying the chi square (x^2) statistical device to each set of responses to each issue; (3) by interpreting the response in light of the comparison; and (4) by generalizing from the interpretation in terms of whether or not there was sufficient basis from which an objective could be derived. (Sufficient basis was determined statistically to constitute at least 56 per cent majority agreement among leaders on the principle underlying the major issue.)

From the analysis forty-eight objectives were established in these areas of business education, which are the same areas used in the Hayden study: Functions of Business Education; Organization and Administration; Curriculum; Bookkeeping; Distributive Education; General Business Education; Office and Clerical Practice; Shorthand and Transcription; and Typewriting.

The interpretation of the practices, in terms of the objectives, was based on the thirteen doctoral studies which reported practices between 1950 and 1957.** In an effort to validate the interpretation, the investigator requested each of the authors of the state studies to submit, in terms of the major issues used in this investigation, his own interpretation of the practices reported in his study; eleven authors responded.

Practices were classified into the following five degrees of divergence representing their relationship to the objective: close (76%-100%); substantial (51%-75%); occasional (26%-50%); remote (1%-25%); and none (not measurable).

The following general conclusions were made:

1. The 1957 leaders reaffirmed the opinions held by the 1950 leaders in approximately two thirds of the sixty-eight major issues; they continued to disagree approximately to the same extent on fifteen of the same issues.
2. Considerable controversy existed on the issues in the Organization and Administration area and in the Bookkeeping area; there was strong agreement among the majority of 1950 and 1957 leaders on all issues pertaining to Typewriting.
3. More than one half of the principles agreed upon were not related or were only remotely related to practices.
4. Practices in the Organization and Administration area and the Curriculum area showed the heaviest divergence with approximately two thirds of the objectives in these areas not related or only remotely related to practices.
5. The relationship between practices and objectives in the office education phase of the program was consistently strong.
6. The Typewriting area maintained a stronger relationship between practices and objectives than any other area; the Distributive Education area showed the weakest relationship.
7. Even though there was a wide area of agreement among leaders on a substantially large body of principles, the practices, in general, disclosed a significantly wide divergence from the objectives represented by these principles.

Microfilm $4.50; Xerox $15.20. 352 pages.

*Carlos K. Hayden, "Major Issues in Business Education" (unpublished Doctor's dissertation, The Ohio State University, Columbus, 1950), 392 pp.

**The states represented by these studies include California, Colorado, Georgia, Idaho, Kansas, Michigan, Minnesota, New Mexico, Ohio, Oklahoma, Pennsylvania, Texas, and Wisconsin.

THE EFFECT OF FREQUENCY OF COLORING BOOK USAGE UPON THE CREATIVE DRAWINGS OF THIRD GRADE CHILDREN

(L. C. Card No. Mic 59-753)

Robert Alphonse Daniel, Ed.D.
The Pennsylvania State University, 1958

STATEMENT OF THE PROBLEM

This research project was designed to discover the answers to some questions related to the drawings of third grade children and to the frequency with which they use coloring books:

These questions were concerned with:

(1) The relationship of mental age, chronological age, socio-economic status, sex, drawing motivations and schools to the quality of drawings done by third grade children.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

(2) The existence of possible effects of coloring book usage on the manner in which third grade children draw and on the quality of their drawings.

(3) The relationship between parental reports of frequency of coloring book usage and the quality of drawings done by third grade children.

and

(4) The relationship between judged coloring book influence, hereinafter called J. C. B. I., and the quality of drawings done by third grade children.

Procedure

Questionnaires were used to obtain information regarding the variables which were mentioned in the statement of the problem. The 212 children who made up the population each did three drawings, one for each of the motivations. These drawings received scores ranging from 1 point for the lowest level of creativity to 5 points for the highest level of creativity evidenced in them. The drawings were judged for levels of creativity prior to the classification of the population according to the variables. The drawing scores were subjected to statistical analyses which included coefficients of correlation, analyses of variance, t tests and chi square tests. Numerical values of 1, 2, and 3 points were given, in this order, to the frequent, average and infrequent or non-users of coloring books. Following the evaluation of the drawings for levels of creativity they were judged for evidence of the effect of frequency of coloring book usage on drawing technique.

Product moment and partial correlations were done to discover the relationship between J. C. B. I. and drawing quality.

Findings and Conclusions

A series of partial analyses of the data which involved analysis of variance, failed to show any significant effect on the quality of the drawings which could be attributed to frequency of coloring book usage. The t test for the coloring book variable produced only one significant t, out of twelve t's, indicating that there was no consistently significant effect on the quality of the drawings which could be attributed to the frequency of C. B. U.

Most of the subordinate variables seemed to influence the drawing scores. The groups making the highest drawing scores were: girls, the high socio-economic group, the high M. A. group and the younger children. The schools from which the population came had a significant influence on the drawing scores, in that certain school groups made markedly higher scores.

The results of a t test between judged coloring book influence scores made by 30 frequent users and 30 infrequent or non-users of coloring books, indicated that frequency of coloring book usage had a significant effect on drawing technique. A correlation between drawing quality scores and judged coloring book influence scores indicated that children with the higher J. C. B. I. scores made higher drawing scores as a group than did children whose drawings showed less influence of C. B. U.

The results of this correlation do not coincide with the pattern of generally non-significant F's and T's for the coloring book variable. The partial correlation revealed the possible existence of variables that were not included in this study which might have influenced both drawing scores and coloring book influence scores.

It appears then that coloring book variables other than frequency of usage need to be included in any future investigation of the problem.

Microfilm $2.00; Xerox $6.20. 126 pages.

THE COMPARATIVE EFFECTIVENESS OF THREE KINDS OF TEACHER-STUDENT RELATIONSHIPS IN THE TEACHING OF BUDGETARY ANALYSIS TO SELECTED YOUNG ADULT DAIRY FARMERS IN PENNSYLVANIA

(L. C. Card No. Mic 59-755)

Robert Scott Dotson, Ph.D.
The Pennsylvania State University, 1958

STATEMENT OF THE PROBLEM

The study was designed to investigate the possibilities for the effective teaching of farm management so that it might be understandable to young adult dairy farmers in the process of becoming established in farming. The phase of farm management selected for study was farm planning, generally accepted as the central core of farm management. The budgetary analysis approach to farm planning was selected as the soundest basis for selecting from among promising alternatives the optimum alternative farm plan. It appears to offer the farmer the opportunity to most nearly attain his recognized farm and family goals. Three presentation methods, or teacher-student relationships, were compared in the teaching of an eight-period unit in budgetary analysis to discover whether there were any differences in the effectiveness of the methods for teaching young farmers.

The purposes of the investigation were to develop a farm planning approach that might be used by rural educators and to organize farm planning teaching materials with young adult dairy farmers in order to test hypotheses concerning the teaching effectiveness of three teacher-student relationships.

PROCEDURE OF THE INVESTIGATION

The procedure was an experimental one based on the major null hypothesis that there are no differences in the effectiveness of teaching the budgetary analysis unit to young adult dairy farmers using any of the three instructional teacher-student relationships studied. Teacher-student relationships tested included the following: Relationship A, consisting of six planned periods of organized systematic on-farm instruction and two planned periods of organized systematic classroom instruction; Relationship B, consisting of eight periods of classroom instruction; and Relationship C, consisting of a combination of three on-farm and five classroom periods of planned instruction in budgetary analysis for the young adult dairy farmers. A fourth presentation method, Relationship D, consisted of a control relationship where the regularly enrolled young farmers were not given the special unit of instruction. Three component hypotheses according to which the major hypothesis was tested were formulated and measured by means of the following criterion instruments: 1) the General Principles Test; 2) the Approved Practices Check List; and 3) the Decision Making Test.

Nineteen schools and 114 young adult dairy farmers in Pennsylvania were selected for the study by means of specific criteria. Eighty-nine of the farmers received budgetary analysis instruction in sixteen cooperating schools, while twenty-five farmers were enrolled in classes in the cooperating schools where the unit was not included in the instructional program. Analysis of variance, analysis of covariance, the Snedecor t-test, and the Snedecor "relative efficiency" estimate for covariance were used, the 5 percent level being chosen for significance for all tests.

CONCLUSIONS

It is concluded: 1) that there were no significant differences in the effectiveness of teaching among the relationships as measured by either the General Principles Test or the Approved Practices Check List; 2) that significant differences did exist in the effectiveness of the different teacher-student relationships in teaching budgetary analysis as measured by the Decision Making Test, disclosing that Relationship C, the combination of on-farm and classroom teaching, was superior to other methods; and 3) that, of the regularly enrolled young adult dairy farmers included in the study, the farmers in schools in categories providing instruction made scores significantly higher than those made by farmers not taught the unit in budgetary analysis as measured by each of the three criterion instruments. It was implied that the teaching unit developed for the study accomplished its purposes; and it was recommended that further study be made of the presentation methods investigated. The teachers in the study saw a need for more instruction of the quality demonstrated. It was verified that young adult farmers can profit from organized systematic instruction.

Microfilm $3.40; Xerox $11.60. 261 pages.

THE DEVELOPMENT OF A CRITICAL THINKING TEST

(L. C. Card No. Mic 59-505)

Robert Hugh Ennis, Ph.D.
University of Illinois, 1958

Critical thinking ability is defined as ability to evaluate statements for their acceptability in accord with the presented set of rules. The set of rules covers the areas of induction, deduction, and semantics; and gives some attention to particular problems in the field of evidence, values and assumption-finding.

Induction. Explanatory power and testability are the essential criteria offered in induction. Deduction plays a role in both of these criteria.

Deduction. The inconsistency of the truth of the premises with the falsity of the conclusion is offered as the criterion of deduction.

Semantics. Ambiguity and the pitfalls of persuasive language are the concerns here.

Evidence. The principal offering is the rules of evidence of the Anglo-American legal system that are not peculiar to the courtroom.

Values. Basic value questions are not presumed to be handled by the presented set of rules. Matters of consistency are considered, however.

Assumption-finding. Logical necessity of an alleged assumption is not considered to be a suitable criterion for its establishment as an assumption. Suitable criteria, such as gap-filling, empirical necessity, and consensus of the experts, are presented.

It is argued in some detail that the set of rules is appropriate for making decisions about the acceptability of statements, but it is not held that they are sufficient. In particular the rules do not, in most cases, tell us how much favorable evidence is enough for making the judgment, "I accept the statement".

Because of deficiencies in existing tests, the I. D. S. Critical Thinking Test has been developed, using these rules for its basis. The test is intended for use as a research instrument in evaluating the effectiveness of methods of teaching critical thinking in high school and college. Presumably it would have other uses as well.

A series of pre-tryouts with early editions was followed by the 1957-58 series of tryouts using 2456 students from ten high schools and two colleges on two forms--Form Y and Form Z. Form Y shows promise at all the levels tested, while Form Z shows promise only for the more sophisticated students.

Item analysis data appear to be satisfactory. Reliability indications are lower than desired by test publishers. Validity indications are very good. However, it is too early to make any firm judgment on the basis of empirical results. Much more data must be gathered using the revisions of Form Y and Z--such revisions having been made on the basis of the 1957-58 tryout series--and parallel forms yet to be developed. The process of test development is a long continuing one, but it is felt that a satisfactory foundation has been laid.

Microfilm $3.55; Xerox $12.00. 274 pages.

PARENT AND TEACHER PERCEPTIONS OF THE ROLE OF ELEMENTARY SCHOOL TEACHERS

(L. C. Card No. Mic 59-1422)

Lloyd Cecil Gass, Ed.D..
Stanford University, 1959

Supervisor: J. J. MacConnell

The Problem

Many present-day teachers differ from teachers of a generation ago in the extent of their professional training and insight and in their responsibilities to an emerging curriculum. As a result, parents are often confused about the role of teachers, and teachers find it difficult to delineate their own functions and status precisely. If teachers and parents differ markedly in these perceptions tensions and misunderstandings may develop in their relationships.

The purpose in the present study was to compare the opinions of a sample of parents and teachers of one community on issues related to the role and status of public elementary school teachers.

Research Design

Parents and teachers reported issues on which they had disagreed. A questionnaire was prepared to include

questions based upon these issues with a choice of responses for each question. The instrument was tested for clarity and relevancy and mailed to a random sample of 251 parents and 124 teachers. Standard error of per cent and standard error of difference formulae were employed.

Results

Seventy-eight per cent of the parents and 87 per cent of the teachers returned the questionnaires. For 19 of the 26 items the differences between the proportions of parents and teachers who selected the response most popular with parents were statistically significant at the 5 per cent level or better.

Parents and teachers differed significantly in the proportions which believed that present-day teachers excell teachers of a generation ago in effective instruction in the 3 R's and in general competency. About one-half of the parent respondents believed that contemporary teachers had made no improvement in these areas.

The proportion of parents who believed that teaching the 3 R's was the major function of the teacher was almost double that of teachers who made this choice. Teachers were more inclined to favor the development of social skills as their principal objective. Teachers attributed to parents an emphasis upon the 3 R's substantially greater than parents reported for themselves.

About one-third of the parents were unwilling to approve of investigations by teachers of the home conditions of a child. Parents, to a greater degree than teachers, favored the allocation of extra teacher-time to slow-learning pupils. Parents revealed a tendency to grant to teachers the authority to retain a child in a grade for a second year, while teachers generally believed that parents should make the final decision.

The majority of parents expected teachers to enroll in professional courses at least every two or three years, and did not feel that participation in community activities should be regarded as a professional responsibility for teachers.

Almost twice the proportion of teachers as of parents believed that teachers should live by higher standards of conduct than would be expected of "average" members of the community. Parents accorded to teachers no special community status. They generally agreed that teachers participate in community affairs to the same extent as do most community members, but did not accord them any special leadership status. Parents generally felt that teachers do not have ideas and behaviors which set them apart from other people. There was little evidence that parents perceived teachers according to traditional stereotypes.

The largest proportion of parents and the smallest proportion of teachers believed that parents received most of their impressions of the teacher and his job from first-hand observations.

Conclusions

Parents and teachers who participated in this survey differed markedly in their perceptions of the teacher and his job. To a lesser degree, teacher respondents revealed a lack of accordance on many of the issues. It seems fair to assume that these factors contribute to tensions in parent-teacher relationships.

Microfilm $3.20; Xerox $11.00. 248 pages.

SOCIAL SCIENCE GENERALIZATIONS FOR USE IN THE SOCIAL STUDIES CURRICULUM: PROTECTING AND CONSERVING HUMAN AND NATURAL RESOURCES

(L. C. Card No. Mic 59-1423)

Owen Chapman Geer, Ed.D.
Stanford University, 1959

Supervisor: R. E. Gross

Purpose of the Investigation

This dissertation is one of a series of studies intended to identify and classify generalizations from selected social science publications, which would provide sources of curriculum material for elementary social studies. Ten basic human activities were chosen as logical divisions for this research. These provide a convenient means for cross-disciplinary analysis and order the results for easy referral to present curriculum patterns.

This particular study deals with man's activity in protecting and conserving human and natural resources. Literature has been examined in the social science fields of anthropology, economics, geography, political science, social psychology and sociology which, together with history, constitute the richest sources for social studies curriculum content. Since each of these disciplines provides for its own historical perspectives, only one basic reference in history was analyzed. In addition to these sources, generalizations were drawn from selected books in the area of conservation and protection of human and natural resources. These generalizations were categorized and synthesized for future validation and use by other researchers.

Procedure

The procedure used in this research calls for the careful selection of a bibliography representative of the areas included in the topic and the identification of generalizations on the basis of criteria rigidly defined by the team of researchers. Juries of specialists in the social sciences and authorities in the field of the human activity, assisted in the development of the bibliography. From each of the six social science fields, six basic books were selected and analyzed by each of the researchers in terms of his own human activity. The supplementary bibliography was unique to each study and consisted of as many additional titles as seemed necessary to provide adequate coverage. For this study, 55 additional books were analyzed.

A generalization was defined for the purpose of this study as a "universally applicable statement at the highest level of abstraction relevant to all time or stated times about man in his relation to society engaging in the basic human activity of conservation and protection of human and natural resources."

Each of the volumes of the final bibliography was carefully searched for statements which fell within this definition. A total of 443 generalizations were extracted and coded. The following examples are illustrative:

> "Continuity of tenure is basic to proper soil management, because a constructive program means several consecutive years of scheduled activities."

> "Since mineral resources are exhaustible . . . only through wise and careful use can the supply be maintained for use."

"Technology not only makes conservation more necessary, it also tends to make it seem less necessary to many of the voters."

Categories were then determined, into which the generalizations were classified, on the basis of the areas most frequently represented in the generalizations. Forty-four categories seemed to provide logical sub-divisions for the major areas of: (1) Physical Elements, (2) Biotic Elements, (3) Material Culture and Its Sanctions, (4) Social Institutions and Processes, (5) Man, and (6) Interrelated Statements. Similar statements were subsummed under a representative or synthesized generalization, making a total of 225 generalizations which were reported as the data. Of these, approximately 77% came from conservation references, and the balance from books in the social science field.

Conclusions

This study provides an orderly group of generalizations which illustrate the extent of concern which social science writers have for the human activity of conserving and protecting human and natural resources. In addition, it includes basic generalizations of conservation authorities. These generalizations should serve as: (1) resources for curriculum development and instructional purposes, (2) as an indication of the degree of concern social scientists have for conservation, and (3) as a means of identifying phases of the subject in which their is a paucity of material.

Microfilm $2.50; Xerox $8.60. 190 pages.

AN EXPERIMENTAL DETERMINATION OF THE VALUE OF SELECTED VISUAL AIDS IN TEACHING BEGINNING MECHANICAL DRAWING

(L. C. Card No. Mic 59-758)

Everett Ruthven Glazener, Ed.D.
The Pennsylvania State University, 1958

The study was designed to investigate the hypothesis that the achievement of students in selected units of beginning mechanical drawing (first eighteen to twenty-seven clock hours) is greater when selected visual aids (excluding film) are utilized in addition to traditional methods.

The control-experimental group technique was employed and the two techniques of instruction differed only as to the medium used in teaching the principles in the units of measuring, orthographic, dimensioning, and isometric drawing. A jury assisted in selecting these units and the visual aids as applicable for use in experimental classes.

Final data were secured from fourteen classes in mechanical drawing, consisting of 217 boys enrolled in four junior high schools in Pennsylvania during the spring semester of 1957. The students had not received previous formal instruction in mechanical drawing and were randomly assigned to control and experimental classes.

An attempt was made to match classes on the basis of the Series AA, Minnesota Paper Form Board spatial relations test, intelligence quotient and mental age. This was not possible because the control group was definitely superior in M. A. and I. Q., with superiority suggested on the MPFB test.

Criteria applicable to each unit were developed to check actual student performance. These tests were administered within a specified time limit after all instruction in the particular unit had been applied by the students. No assistance was given to the students during the tests.

The objectivity and reliability of all scoring done by the writer was checked by comparing the scores of other industrial arts teachers on random samples of drawings using the same validated score card.

When appropriate, the t-test for significance of the differences between means and standard scores was used. An interpretation of relationships as expressed by coefficients of zero-order and partial correlation were used when expedient.

The evidence from this investigation seems to justify the following conclusions:

1. On the basis of the pre-test measures of I. Q. and M. A. and evidence presented, the results tend to support the hypothesis as stated above. Evidence from MPFB tends to reject the hypothesis.
2. When comparing results of the control and experimental groups in the criteria with the pre-test mental age, the experimental group made more progress than the control group. This progress was more than might be expected by considering their relative beginning positions. The reverse of this was evident in comparison with the MPFB, but it was not significant.

The conclusions were based directly on results of the statistical analysis of data obtained. It is believed that the following generalizations and opinions of teachers are also warranted:

1. That the initial differences between groups may have allowed or caused interaction of other variables to explain performance, rather than the variable of visual aids,
2. That distinctive colors on different views of both two and three-dimensional drawing aids were generally of value for clearly presenting some demonstrations and other instructional material, and
3. That there was more interest, attention, general comprehension, motivation and participation, and less noise by students in experimental classes than those in control classes.

In view of the findings and implications of this research, the following suggestions might be made subjects for further investigation:

1. That subsequent research be made with new or different visual aids in additional segments of drawing and other areas of industrial arts,
2. That similar studies be made in industrial arts at higher levels of training, with both performance and non-manipulative factors being measured and compared,
3. That further tests be developed to assist in predicting success in performance and learning in industrial arts subjects, especially mechanical drawing, and
4. That the development and use of visual aids of this

type be encouraged on all levels of teaching and teacher preparation in the industrial arts.

Microfilm $2.00; Xerox $6.60. 137 pages.

A RESOURCE GUIDE FOR SUBSTITUTE TEACHERS IN PUBLIC ELEMENTARY SCHOOLS

(Publication No. 24,473)

George Terry Guess, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Harold D. Drummond

The purpose of this study was the development of a resource guide for use by substitute teachers in the public elementary schools.

A common, current practice in substitute teacher situations is that of the substitute teacher using instructional plans prepared for him by the classroom teacher. It appears that the academic work of the pupils may suffer less interruption, in the absence of the classroom teacher, if that teacher prepares the lesson plans to be employed.

The wisdom of the classroom teacher's planning for work to be done in his absence is challenged. Since only the classroom teacher knows the individual achievement, specific capacity, and social background of the pupils of his group, there has grown an erroneous assumption that only the classroom teacher is capable of planning the child's school experiences.

An analysis of lesson plans as they are usually made by the classroom teacher reveals, however, that such outlines generally include suggestions for organization of only the mechanical aspects of schoolroom routine.

The preparation of a lesson plan which would transmit information of the mechanics of instruction and which would, also, adequately describe activities planned for the intellectual development of the children appears to be a task of almost impossible dimensions for the classroom teacher.

A solution to the problems of maintaining a continuity of educative experiences in substitute teacher situations may be found by consideration of areas other than those which are known, exclusively, to the classroom teacher.

Heretofore, no differences have been recognized between the educational goals of the classroom teacher and those of his substitute. The objective for the two must be compatible but not necessarily identical in all respects. Conditions, under which the substitute works, make the attainment of specific aims of the classroom teacher most difficult.

Transitory goals of the classroom teacher are often acceptable terminal aims for the substitute teacher. Exploration, inspiration, appreciation, and recreation may serve as major objectives for the substitute teacher.

The Resource Guide

"A Resource Guide for Substitute Teachers in Public Elementary Schools" is composed of educational experiences designed to supplement, rather than to extend, the routine classwork of the pupils.

These supplementary materials are of high interest level, require no prerequisite learning situations, and may be successfully completed within half a school day.

In each of six areas, specific suggestions of educationally profitable activities have been made. The six types of experiences included are: fine arts, language arts, mathematics, physical education, science, and social studies.

Each project proposed constitutes a separate Activity Sheet. Information on the Activity Sheet includes the topic of the project, suggested grade levels in which the activity may be used, the minimum time usually consumed by a group in the use of the activity, a statement of educational purpose, the necessary special materials if any are required, and a brief description of procedure.

The use of materials of this nature will allow the substitute teacher to approach his assignment group with security in the knowledge that he, too, is prepared to participate in all the educational activities of the day.

Microfilm $2.75; Xerox $9.40. 210 pages. Mic 59-1927.

AN EXPERIMENTAL STUDY OF THE EFFECT OF TRAINING IN SENTENCE STRUCTURE ON READING COMPREHENSION

(L. C. Card No. Mic 58-2028)

Jack B. Hetrick, Ed.D.
University of Pittsburgh, 1958

The purpose of this study was to test the hypothesis that pupils will show a gain in reading comprehension after receiving extra training in sentence structure.

Seventy-five pairs of seventh-grade pupils were matched as to reading comprehension score, intelligence, and sex. The technique of equivalent grouping was used. In the course of approximately three and one-half months, extra training in those elements of grammar having to do with sentence structure was given to one of the groups; the other group did not receive this training. During the three and one-half month period of the experiment, both groups received the training in sentence structure that was usually offered in the curriculum of the school. The extra training given to the experimental group took the form of additional explanation and extra practice in the skills involved.

At the completion of the experimental training, the subjects were given a different form of the same reading comprehension test used at the beginning of the experiment. Comparisons were made between the gains made by the experimental and control groups. These comparisons were made between the mean gains made by the whole groups as well as by subgroups of the whole groups. The subgroups were comprised of the upper and lower thirds of the total groups as to reading comprehension and the upper and lower thirds as to intelligence. Comparisons were also made on the subscores of Paragraph Comprehension, Location and Understanding of Details, Organization of Ideas, and Grasp of Total Meaning.

The gain in silent reading comprehension (total score) was greater for the control group than for the experimental group. In two of the subscores the experimental group showed greater mean gains than did the control group. None of the gains was significant at the five per cent level of confidence. The data indicated that no significant gains were made by either the poor readers or the good readers. It is of interest to note that the poor readers of the experimental group made slightly greater gains than did the poor readers of the control group. The lower third (intelligence)

of the experimental group showed greater gains than did the corresponding third of the control group, but the differences in gains were not significant at the five per cent level of confidence.

Subject to the conditions under which the study was carried out, the following conclusions are offered:

1. There is no evidence to support a conclusion that the extra training in sentence structure given to the experimental group in this study resulted in any significant gain in silent reading comprehension.

2. There is some evidence to support a conclusion that the activities carried out by the control group may have had a greater effect in improving silent reading comprehension than did the intensive training in sentence structure.

3. The data suggest that the intensive training in sentence structure produced greater improvement in silent reading comprehension among the poor readers than among the good readers.

4. The data suggest that the intensive training in sentence structure produced greater improvement in silent reading comprehension among lower I.Q.'s than among higher I.Q.'s.

5. There is evidence to support a conclusion that the subjects included in this study tended to reach a saturation point in the learning of those elements of grammar which have to do with sentence structure.

Microfilm $2.00; Xerox $7.00. 150 pages.

THE RELATIONSHIP BETWEEN MATERNAL EMPLOYMENT AND DEPENDENT BEHAVIOR OBSERVED IN KINDERGARTEN BOYS

(L. C. Card No. Mic 59-1440)

Ethel Alice Hitchcock, Ph.D.
Stanford University, 1959

Supervisor: Fannie R. Shaftel

This study was undertaken to explore the problem of whether the children of working mothers would differ discernibly and systematically from the children of at-home mothers in dependency behavior as shown in an observational record made by an impartial observer during school hours. Such a problem is relevant at this time because of the increasing numbers of mothers entering the labor force and because previous research has shown that their children are deemed by teachers to be comparatively dependent as well as low in scholastic achievement.

The subjects were thirty-two six-year-old boys, sixteen pairs respectively attending the same kindergartens. Each two children were matched on a number of personal and familial items shown by other studies to be pertinent to the dependency variable; but the two were carefully and unmistakably differentiated as to mother's employment status, one being the child of a full-time, regular worker and the other of a full-time homemaker with no recent work history. A series of spaced observations, totaling sixty minutes in length, was made of each subject in his classroom by a trained observer for whom the working mother's child in any pair had not been identified. The protocols thus collected were analyzed by dividing them into behavior units and categorizing the units into behaviors of dependency (Succorance) and Dependency-replacement (Obedience, Sociability, Dominance, Aggression, Conformity, Submissiveness, Nurturance, Self-Reliance) according to a scheme adapted from that of Whiting. The combined method of observation and classification was used by two researchers with an inter-observer agreement of rho = .80.

The results show no differences significant at the P = .05 level in the dependency displayed in kindergarten by the sons of working mothers as compared with those of at-home mothers. Such non-significant trends as do appear indicate a somewhat greater frequency of adult-oriented behavior for the former children than for the latter ($P < .13$) and a tendency for the children of at-home mothers to be slightly advanced beyond the working mothers' children in substituting social behavior with peers for dependent behavior with children and adults ($P < .06$). However, the total interaction of each group was predominantly child-oriented, and the principal conclusion must be that this, the normative behavior for kindergarten boys, is not altered significantly by the factor of maternal employment.

A subsidiary purpose of the study was the development of a method for assessing such behaviors. Therefore an evaluation was made of the present procedures as a possible aid to future research. The naturalistic setting of the schoolroom was felt to be an appropriate one; but several unobtrusive controls were recommended to equalize the situation to a greater degree for the children observed. The method of analyzing the data, while adequate and revealing in an exploratory investigation, was judged to be too broad for further usefulness; so a narrowing of scope and a greater distinction of variables were suggested for a follow-up study.

The writer's conclusions were that educators must seek beyond the mere fact of maternal employment for causes of dependency in school, and that, if such behavior is considered wholly undesirable, any teaching practices which seem to promote them should be carefully reassessed.

This research was one of two coordinated pilot studies carried on under the sponsorship of the Committee for the Study of Maternal Employment of the American Association of University Women, with support from the McCormick Fund. It was directed by members of the Education and the Psychology faculties of Stanford University.

Microfilm $2.00; Xerox $5.40. 108 pages.

FORMAL RECOGNITION OF MENTALLY SUPERIOR CHILDREN; ITS EFFECT ON ACHIEVEMENT AND ACHIEVEMENT MOTIVATION

(L. C. Card No. Mic 59-1441)

Charles Norman Jacobs, Ph.D.
Stanford University, 1959

Supervisor: H. B. McDaniel

The Problem.--It was the purpose of this research to test some of the exclusive effects of commonly used methods of identifying mentally superior children. The rationale behind this type of investigation was that the process of

individually testing a child and following this testing with parent conferences and teacher conferences would, in and of itself, change the psychological environment of the child to the extent that it would be reflected in his school achievement and achievement motivation. In a sense this was an application of the well known "Western Electric effect" in a school setting.

The hypothesis.--The process of individually testing mentally superior children and following this testing with parent conferences and teacher conferences was called "formal recognition." The use of the word "formal" implies a consciously planned and mutually accepted recognition of mental superiority. As such it is distinguished from the hazy and often uncommunicated opinions which already exist in these situations. It was hypothesized that mentally superior children who have been formally recognized would show increased reading achievement, arithmetic achievement, and achievement motivation.

Research design.--With respect to achievement, this was a pre-test post-test design with an experimental group having been formally recognized being compared with a matched control group. The achievement motivation aspect of the problem was tested by a comparison of post-test n achievement scores of the experimental and control groups. The sample consisted of fifty experimental and fifty control children with intelligence quotients over 121 drawn from fourth, fifth and sixth grades. Each member of the experimental group was individually matched with a member of the control group on initial reading and arithmetic achievement and on social class. The measures of achievement were based on standardized group test scores. Achievement motivation was evaluated by the McClelland Achievement Motivation Scale. Tests of the hypothesis were based on the significance of the difference between means of related samples.

Results.--The results of this research gave no support to the hypothesis that formal recognition would result in increased achievement or achievement motivation. In fact, there was a tendency for the control group to exceed the experimental group in arithmetic achievement gain and in achievement motivation. However, the differences between the groups were not statistically significant.

Conclusion and recommendation.--It was concluded that the effects of formal recognition, while momentarily producing heightened achievement motivation, are insufficient to bring about a significant positive change in the mentally superior child's psychological environment. It was further concluded that the formal recognition of mentally superior children may have a detrimental effect when it is not followed by curricular changes. Since the process of identification employed here, which has been called formal recognition, is frequently practiced by schools without subsequent curricular changes, this observation has serious implications. However, further verification is necessary before the observation can be fully accepted.

Microfilm $2.00; Xerox $5.80. 118 pages.

THE DEVELOPMENT OF A COURSE OF STUDY IN RELATED TECHNOLOGY FOR THE COMMERCIAL ART PROGRAM OF THE SCHOOL OF INDUSTRIAL ART, NEW YORK CITY

(L. C. Card No. Mic 59-1046)

Alfred S. Lane, Ed.D.
New York University, 1958

Chairman: Professor William P. Sears

This investigation was undertaken to develop a course of study that could serve as a guide to teachers in organizing related technical instruction for commercial art students. The course was prepared specifically to fill a need in the vocational curriculum of the School of Industrial Art, a New York City specialized vocational high school.

Development of the course necessitated inquiry as to the specific vocational needs of students of commercial art and the materials and practices by which these needs might be met. In identifying these needs, a comprehensive analysis of the field of commercial art was prepared through on-the-job observations and use of published job descriptions and literature in the field. The analysis so prepared contained descriptions of all the jobs below the managerial levels comprising the occupation, the operations performed, the materials and tools employed, and the knowledges and attitudes required in the performance of the listed duties. The science, mathematics, and technical aspects of the occupation were listed together in one column as related technology.

The analysis was validated by a jury of eight commercial artists who were carefully selected because of their extensive experience supervising the work of high school graduates, and because they represented the major types of employment in the field. The jury checked the analysis for accuracy and completeness, and also identified the jobs open to high school graduates in their first year of employment and the knowledges, skills, and personal qualifications considered essential for such duties. The division of this content between the shop and the related technology course was determined by a consensus of the experienced commercial art and related technical teachers in the program. They also scored all items of related technology in the analysis as either essential, desirable, or not desirable, and the items selected as essential were considered the specific vocational objectives of the course in related technology.

The investigator's part in implementing the program so determined was the preparation of a series of fifteen resource units which contained outlines of the specific aims, outcomes, and their inter-relationships; and descriptions of suggested student and teacher activities, available audio-visual aids, and lists of reference materials. Major decisions in the selection of format and equipment were shared with staff members of the Related Technical Department. Each unit was developed by arranging and selecting activities and materials to offer maximum assistance to teachers in organizing specific teaching units. Other professional schools and commercial establishments were visited to obtain data as to equipment and possible laboratory experiences.

The completed units were submitted to three experienced supervisors and administrators in the field of vocational education for criticism. Minor revisions were

effected as a result, but all units were rated highly as teaching aids.

Equipment needs were compiled by reviewing the resource units and listing the equipment needed to implement the suggested activities. The final listing of suggested equipment was derived through the dynamics of preparing a layout for a laboratory to be included in a new building scheduled for completion late in 1960. The plan so evolved, together with lists of suggested equipment, are included in the appendix to the study. Tryout and evaluation of the course must wait until classes can use the new laboratory.

Microfilm $4.30; Xerox $14.40. 334 pages.

SLIDES FOR PERCEPTUAL-MOTOR SKILLS: AN EXAMINATION OF SOME OF THE FACTORS WHICH MAY MAKE SLIDES EFFECTIVE IN TEACHING A PERCEPTUAL-MOTOR SKILL IN A JUNIOR HIGH SCHOOL INDUSTRIAL ARTS SHOP

(L. C. Card No. Mic 59-1043)

Leonard Robert Lichtblau, Ph.D.
New York University, 1958

Chairman: Professor William P. Sears, Jr.

The Purpose of the Study

The problem of this investigation was to determine the influence of each of several variable factors on the effectiveness of a set of 2" x 2" slides in teaching a perceptual-motor skill in a junior high school industrial arts shop. The six factors tested were selected from a list of forty-two. A committee which consisted of six industrial arts supervisors and teacher-trainers and six audio-visual experts selected the factors.

The Experiment

The factors which were selected by the committee were:

1. Explaining reasons compared with asking exact imitation.
2. Using identical tools and materials pupils will use compared with using items which are only similar.
3. Using attention-gaining devices like arrows and circles compared with not using them.
4. One thought in a frame compared with two or more.
5. Including a summary compared with omitting it.
6. Including a motivation section compared with omitting it.

These six factors were used to differentiate six experimental sets of 2" x 2" slides on "How to Set a Rivet" from a control set, one factor for each experimental slide set.

Seven groups of pupils in junior high school seventh grade classes, each group consisting of eight boys and eight girls, were equated on the basis of reading score and mechanical ability score. Each group was shown one of the slide sets and then was given an opportunity to apply the skill exactly as shown in the slides.

A group of three experienced junior high school metal shop teachers rated the results of the riveting exercise performed by each of the pupils. Each teacher rated each sample independently by comparing it against a scale set up by the three teachers.

Treatment of the Data

Before the data were collected, it had been decided that they would be treated by comparing the riveting scores made by each of the experimental groups against those of the control group, using a "t" test for equated groups. However, after the data were collected, it was discovered that there were only negligible correlation coefficients between the various equating factors and the results of the riveting test. As a result, it was felt that such a test might not indicate valid relationships, and that a "t" test for means of independent samples might be more valid. However, the results of the two methods for calculating "t" were the same. The only result which was reliable at the .05 level or better was the poorer score made by the group which had had reasons explained.

Conclusions

Because of the nature of the specific situation which resulted in the poorer results obtained by the group which had had explanations of why to perform the skill in a certain way, the following conclusion was reached for this variable, "When the sole aim of the slide set is to teach a specific perceptual-motor skill as applied in one situation, no explanations of why certain procedures are to be followed should be included unless the explanations are absolutely essential to follow the rote procedure."

None of the other factors tested showed a reliable statistical difference, although some approached it. The group which saw a slightly different tool from the one it used, and the group which heard several thoughts expressed in the commentary for some of the slides did poorer than the control, although not significantly so. The group which saw "attention-gaining devices" in some of the pictures did better than the control, although, again, not significantly so. Microfilm $2.00; Xerox $5.60. 113 pages.

AN ATTITUDE OF SCIENCE FOR EDUCATION; A STUDY OF EPISTEMOLOGICAL ASPECTS OF MODERN PHYSICS

(L. C. Card No. Mic 59-1179)

Vern M. Pings, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Merle Borrowman

Physicists have made the statement that there has been a revolution in science. This investigation attempts to examine some of the epistemological aspects of this "revolution" to determine if they have implications for educational theory and research. To place the problems of modern physics in a context the attitudes of classical science are outlined.

(1) No "effect" is produced without an antecedent "cause"; it is within the competence of man "to know" the cause of events.

(2) The universe can be analyzed into distinct systems.

(3) The "state" of these systems can be described by dynamic variables which are specifiable to any desired degree of accuracy.

(4) If the behavior of several systems is known, some mathematical formulation exists which can demonstrate the interaction of these systems.

(5) Scientific knowledge must be independent of any specific observer. Nature thus consists of one objective reality which is "knowable" by all men in the same way. This elevates the methodology of science to a position where it is free from the desires, weaknesses, and actions of man.

In reviewing experiments and descriptions of modern physics the operations of experimentation are:

(1) A system or object of study and instruments by which to measure and describe it are selected.

(2) The object of study is made to interact with another system.

(3) Measurements are taken to determine the extent (2) changed the object of study defined in (1).

Working with large distances and velocities or in the atomic realm the classical attitudes become suspect. Einstein's theories demonstrate that space and time must be relativized to make observations from various coordinate systems coincide. This space-time continuum is not observed directly but constructed by mathematical formalism from observable events. The size of atomic particles is so small and energy content so high that the process of observing disrupts the system under study so that the scientist cannot say with certainty that the system measured at (3) is the same one defined at (1). The "cause" of events becomes unidentifiable.

This requires a new attitude toward inquiry if the belief is maintained that science can produce sure knowledge.

(1) While it is assumed there is an "actuality", we have no means at present to make simultaneous measurements of all its aspects; we can only obtain complementary views of it. (2) There is nothing ambiguous about these views if the frame of reference and decisions of the scientist are included in their descriptions; this is necessary because man is limited in his abilities to sense his environment and all measurements in science are finite. (3) Communicable knowledge begins and ends with the observer. Its formulation must go beyond the empirical data because of (2).

Assuming these changes in the attitude of scientific inquiry are significant, two implications seem apparent for education.

(1) If scientific knowledge requires a description of the decisions and frame of reference of the scientist, it cannot be considered devoid of human values. The responsibilities for knowledge acquiring rest with the individual scientist, not with some neutral methodology.

(2) Since the results of inquiry are a function of the knower and his object of study, this relationship must be conveyed when the data and theories of science are taught. Thus the educational process can be committed to neither any single method nor to any single orientation if scientific inquiry is to be encouraged to deal with the uncertainties of our technological environment.

Microfilm $2.95; Xerox $10.20. 227 pages.

HANDCRAFTS FOR THE HOMEBOUND HANDICAPPED: A GUIDE TO THE CRAFTS FOR HOMEBOUND PUPILS, THEIR PARENTS AND TEACHERS

(L. C. Card No. Mic 59-1061)

Mildred Kroll Rich, Ed.D.
New York University, 1958

Chairman: Professor William P. Sears

The purpose of this study was to develop a guide to handcrafts for physically handicapped homebound pupils, their parents and teachers, designed to meet pupils' needs for creative expression and complement their interests. It became necessary (1) to identify the common illnesses and resulting limitations; (2) to identify their desires for creative expression and their interests; (3) to survey the teaching of crafts to homebound pupils in selected areas in the United States; (4) to establish criteria for the selection of projects feasible and desirable for homebound pupils, and to utilize these criteria for the selection of specific craft activities suitable for them; (5) to develop a guide designed for them; and (6) to validate the guide.

Many parents skim through magazines, books, and newspapers unsuccessfully to find ideas and projects which their handicapped children may feel inclined or able to do. Many teachers of homebound undertake to provide leisure time activities in the form of handcrafts for their pupils. The guide should assist them because the crafts are recommended for use with a type of involvement rather than for a particular illness.

The surveys of handcrafts in large cities of the United States and in agencies servicing the handicapped emphasized the need for this study by their absence of such programs. The available published literature offers no organized source of specific directions concerning the handcrafts to be taught to physically handicapped homebound children.

The population of 311 used in this study was selected from the group of approximated 1,900 pupils on register with the Bureau for the Education of the Physically Handicapped, Board of Education, City of New York, in June 1955. Arranging the illnesses and symptoms medically, the neuromuscular system group was the largest with 120 pupils afflicted with post poliomyelitis, muscular dystrophy, cerebral palsy, spina bifida, epilepsy, and others. The skeletal system group had 77 affected with bone fractures, epiphyseolysis, rheumatoid arthritis, scoliosis, kyphosis, Perthe's disease, and others. The cardio vascular system group had 50 of whom 44 had rheumatic fever and hemophelia. The respiratory system group had 28 pupils with asthma and arrested pulmonary tuberculosis: the genito urinary system group had 18 of whom 17 were ill with nephritis or nephrosis. The balance were distributed through the digestive system group, skin, generalized disease, and miscellaneous.

On the questionnaires pupils were asked to list handicaps of legs, arms, hands, speech, eyes, and ears, in addition to their spontaneous wishes, favorite school subjects, recreational and reading activities, amusements, and hobbies. All information was transcribed to I. B. M. punched cards which provided an efficient means of determining frequencies. Thirty-eight tables were constructed from this information.

In developing criteria for the selection of craft projects, pupils' handicaps, interests, and needs for creative expression were considered. After many refinements the thirty projects in the guide were arranged for (1) one hand involvement, (2) two hands involvement, (3) limited strength for grasping, (4) limited hand and eye coordination, (5) "good hands" in wheel chairs or beds, and (6) supplementary projects. The members of the jury of craft teachers indicated their judgment concerning these projects which were familiar to them through usage. Since the selection of projects was obtained from experienced craft teachers of the homebound, validation ensued. The written instructions were given to pupils, parents, and teachers to insure "operational validity".

Microfilm $3.55; Xerox $12.00. 274 pages.

THE RELATIONSHIP OF THE TEACHER'S KNOWLEDGE OF THE STUDENT'S BACKGROUND TO THE EFFECTIVENESS OF TEACHING: A STUDY OF THE EXTENT TO WHICH THE EFFECTIVENESS OF TEACHING IS RELATED TO THE TEACHER'S KNOWLEDGE OF THE STUDENT'S PERSONAL BACKGROUND

(L. C. Card No. Mic 59-1041)

Horace W. Sturgis, Ph.D.
New York University, 1958

Chairman: Professor Alonzo F. Myers

The Purpose and Design of the Investigation

The purpose in the investigation was to determine the extent to which the effectiveness of teaching, as measured in terms of student achievement and student ratings of the teacher, is related to the teacher's knowledge of the student's personal background. The investigation was experimental in design and involved six groups of students taught by three teachers in the School of Physics at the Georgia Institute of Technology, Atlanta, Georgia, during the fall quarter, 1956.

Each of the three teachers taught two groups of students. One of the two groups of each teacher was taught under experimental conditions; the other group was taught under controlled conditions. The single independent variable introduced into the experimental situation was the increased knowledge of the personal backgrounds of the students which the teachers possessed about the students in the experimental groups, but not about the students in the control groups. All other variables related to the classroom and laboratory procedures were assumed to have been either equated or held constant under controlled conditions.

Procedures

The ratings of the teachers were secured through the use of the Georgia Tech Faculty Evaluation Form, which was filled in by the students at the conclusion of the experiment. The achievement of the students was measured through the use of the Mechanics Section of the Cooperative Physics Test for College Students published by the Educational Testing Service, Princeton, New Jersey. This test was administered to the students at the beginning and again at the end of the experiment.

The analysis of the student ratings of the teachers was made by employing analysis of variance methods and by applying t-tests of significance to the differences in the ratings. In analyzing the achievement of the students, adjustments were made for the effects of three variables assumed to be related to the magnitudes of the students' gains in achievement: (1) the students' records of previous academic performance, i.e., their scholastic point averages, (2) the students' scholastic aptitudes, and (3) the students' beginning knowledge of mechanics.

The students' actual gains in achievement (ending scores minus beginning scores) were adjusted for the effects of the three concomitant variables by employing methods of regression. When the effects of the three variables had been eliminated, the differences in the adjusted gains in achievement were tested for significance by means of the usual analysis of variance methods.

Findings and Conclusions

According to the findings in the investigation, the students not only made significantly greater gains in achievement, but also rated their teachers significantly higher as instructors when the teachers possessed an increased knowledge of the personal backgrounds of the students. On the basis of these findings, it was concluded that the effectiveness of teaching, as measured in terms of student achievement and student ratings of the teacher, is related to the teacher's knowledge of the student's personal background.

Although the findings in the investigation were limited to the study of the student ratings of only three teachers and the achievement of only six groups of students in a single field of study (mechanics), the high levels of significance which were found for the differences in the ratings of the teachers and for the differences in the gains in achievement of the students suggest that similar findings might be expected if such an investigation were to be repeated not only in physics, but also in other fields of study. Certainly, the findings provide evidence to support the need for further study of the relationships between the many functions of the teacher and his knowledge of the personal backgrounds of the students.

Microfilm $2.70; Xerox $9.40. 208 pages.

SOME CORRELATES OF PREJUDICE TOWARD NEGROES IN ELEMENTARY AGE CHILDREN: SATISFACTION WITH SELF AND ACADEMIC ACHIEVEMENT

(L. C. Card No. Mic 59-1430)

Benjamin Robert Tabachnick, Ed.D.
Stanford University, 1959

Supervisor: Fannie R. Shaftel

The purpose of this study was to examine the following as possible correlates of prejudice toward Negroes in elementary age children: satisfaction with self in each of ten categories of personal and social behavior, academic achievement, sex.

Four hypotheses were tested: (1) Prejudice varies systematically with the degree of satisfaction with self in

children. (2) Children who are more satisfied with themselves will be less prejudiced than children who are less satisfied with themselves. (3) Prejudice will not vary systematically with an apart- from-self measure of frustration such as achievement in school subjects (reading and arithmetic) with intelligence controlled. (4) Boys will not differ significantly from girls in prejudice.

Research Design

Three hundred two Caucasian children, 151 boys and 151 girls, attending the fifth grades of six elementary schools in a suburban community in the San Francisco Bay Area, were studied. These children had very probably had little or no intimate contact with Negroes for the two years prior to the study (such as attendance in the same school or classroom).

Teachers administered the Gough, Harris, Martin, and Edwards prejudice index[1] to these children in order to obtain a measure of each child's degree of prejudice towards Negroes. Children's responses to a self-concept inventory (developed by Professor Pauline S. Sears and her associates at the Stanford University Laboratory of Human Development) measured the extent to which each child was satisfied with himself in each of ten categories of personal and social behavior. Responses to these two instruments were correlated. Average Grade Level Achievement was correlated with prejudice scores.

Achievement and intelligence scores were correlated for the sample. Plus and minus half of the standard error of estimate was allowed arbitrarily to define a normal zone on either side of a regression line. Children were classified as Under-Achievers, Normal-Achievers, or Over-Achievers as a result of their falling below, within, or above the normal zone.

Mean differences among the achievement groups in prejudice and satisfaction with self (scores in each of the Self-Concept Inventory categories and the total Self-Concept Inventory score) were tested for significance through the use of the simple analysis of variance technique. Whenever mean differences among the groups were discovered to be significant, an analysis of covariance was performed in which mean differences in prejudice among the three groups were tested for significance after mean differences in satisfaction with self had been controlled. The same statistical procedures were used to test the significance of mean differences between boys and girls in prejudice and satisfaction with self.

Results and Conclusions

Among the conclusions drawn from the results of the study were the following: (1) Satisfaction with self in eight of the categories of the Self-Concept Inventory is related to prejudice in children. Satisfaction with self in the categories dealing with personality characteristics and social relations with peers is more powerfully related to prejudice in children than is satisfaction with self in any of the other categories of the Self-Concept Inventory. (2) Satisfaction with physical ability and appearance, satisfaction with work habits, and average grade level achievement (intelligence not controlled) are not related to prejudice in children. (3) The relationship between prejudice and satisfaction with self is in the predicted direction. (4) Since the three achievement groups did not differ significantly in prejudice either before or after significant differences in satisfaction with self were controlled, it is concluded that the level of academic achievement with intelligence controlled is not related to prejudice in children. (5) Boys do not differ significantly from girls in prejudice either before or after significant differences in the degree of satisfaction with self are controlled.

Microfilm $2.00; Xerox $4.20. 77 pages.

1. Gough, Harris, Martin, and Edwards, "Children's Ethnic Attitudes: I. Relationship to Certain Personality Factors," Child Development, 21:83-91, 1950.

METHODS AND MATERIALS IN THE CORE CURRICULUM: SOME SUGGESTIONS FOR TEACHERS (VOLUMES ONE AND TWO)

(L. C. Card No. Mic 59-1121)

Gordon Forrest Vars, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Roosevelt Basler

The purpose of this dissertation was to gather together into one central study a large number of suggestions for teaching in a core program. Such a study appeared to be warranted by the shortage of qualified core teachers and the relative scarcity of "how-to-do-it" materials on core teaching.

In preparing this dissertation, the writer drew upon his many years of experience as core teacher and coordinator of audio-visual education, as well as a wide survey of publications on core and on methods in general. The chapters which make up the bulk of the study were prepared for inclusion in a professional book on the junior high school curriculum. This text is currently being written by Dr. William Van Til of New York University, Dr. John Lounsbury of the University of Florida, and the writer.

Findings of the Study

Writing in this field was found to suffer from a lack of clarity because of the ambiguous use of such terms as "core," "unified studies," "common learnings," and the like. After distinguishing between unified studies and "true" core, the writer concluded that problem-centered teaching, teacher-student planning, and group work were procedures most characteristic of the latter type of program. However, core teaching methods were not found to be unique. Successful core teachers use many procedures proved effective by those teaching within other curricular organizations. With respect to core content, Van Til's tri-fold approach to curriculum building was recommended in order to develop a sound and well balanced core program.

Specific suggestions for effective core teaching were then offered in chapters devoted to pre-planning for core teaching, problem-centered teaching, developing basic skills, providing for guidance and for exceptional children, obtaining and evaluating instructional materials, and organizing, filing, and using instructional materials. Additional chapters described a core class in action, identified the problems with which the study was concerned, and set forth briefly the theoretical foundations of a core curriculum based upon adolescent needs, democratic values, and social realities. A summary chapter included suggestions for further study in the area of core teaching methods and materials. Microfilm $7.05; Xerox $24.40. 556 pages.

ENGINEERING, AERONAUTICAL

INVISCID FLOW AROUND A BLUNT BODY OF A REACTING MIXTURE OF GASES

(L. C. Card No. Mic 59-1354)

Wilbert Lick, Ph.D.
Rensselaer Polytechnic Institute, 1958

Supervisor: Professor T. Y. Li

Because of the low densities and high temperatures encountered in present-day hypersonic flight, the assumption of chemical equilibrium in the flow about a blunt body has become questionable. To determine the effects of chemical non-equilibrium on the flow about a blunt body, a detailed analysis of the flow field is necessary.

The present paper describes two different procedures and their regions of applicability, an inverse method for the subsonic and slightly supersonic regions and a method of characteristics for the continuation of the solution around the shoulders of the body. A rough analysis of dissociation and recombination rates is presented in order to perform numerical computations.

Results for three examples for the flow of air and one for the flow of pure oxygen through a prescribed shock shape at a Mach number of 14 and for free stream density and temperature corresponding to the density and temperature of air at 100,000 ft. are presented. For air, various shock radii are chosen so that a typical relaxation distance for oxygen dissociation near the stagnation streamline in comparison with the detachment distance is

(i) small and therefore the flow is practically in equilibrium throughout,

(ii) of the same order of magnitude and the flow is only partially in equilibrium, and

(iii) very large and no dissociation or recombination occurred.

The results of the three examples show appreciable differences in the flow quantities, especially density and temperature, among themselves and in comparison with the calculated results for the flow of pure oxygen corresponding to the case (ii) mentioned above. The limitations and methods of increasing the accuracy of the numerical integration are also discussed.

A comparison of the results with Freeman's non-equilibrium theory, other equilibrium theories and experimental results is given.

Microfilm $2.00; Xerox $6.00. 121 pages.

ENGINEERING, CHEMICAL

INTENSITY DISTRIBUTION IN CYLINDRICAL AND BOWL SHAPED TRANSDUCERS AND SONO-DIALYSIS OF A CAUSTIC SOLUTION

(L. C. Card No. Mic 59-1188)

Narendra Nath Bakhshi, Ph.D.
Virginia Polytechnic Institute, 1957

In ultrasonic processing it has been a practice to measure intensity of ultrasonics as a product of plate current and voltage as indicated on the ultrasonic generator. At low frequencies the measurement of absolute sound intensity is simple. However, at ultrasonic frequencies the problem becomes complicated by the diffraction effects on account of the size of the measuring device.

In this investigation, a probe has been constructed and evaluated in the case of cylindrical and bowl shaped transducers. The probe essentially consists of a small barium titanate cylindrical element (1/16 inch in diameter and 1/16 inch in length) which was used as a detector-convertor of the sonic pressures. The alternating voltages thus produced were detected by a vacuum tube voltmeter.

The mapping of intensity distribution in a cylindrical transducer (soni-cell type L-250), 2-1/2 inches in diameter and 7-1/4 inches in length, was performed at 22 and 420 kilocycles per second at power control levels four, five, and six on the ultrasonic generator, and at depths of one, two, three, four, five, and six inches from the top of the liquid level. A total of 20 observations were made at each depth for one power control level and for one frequency. It was found that at both the frequencies the intensity was small at the top two-inch portion of the transducer and increased gradually for the remaining five-inch portion. The intensity values varied from 0.05 to 0.12 volts for all of the measurements at 22 kilocycles per second. Similar observations were made at 420 kilocycles per second. In this case, for power control levels of four and five the intensity first increased with the depth, reached a maximum value at about the middle of the transducer, and then decreased again. That is, the curves for intensity versus depth showed a bulge in the middle. At power control level six the regular curve was obtained, showing an increase in intensity as the depth increases. The intensity values at this frequency ranged from 0.4 to 1.4 volts which was about ten times as much as in the case of 22 kilocycles per second.

In the case of the bowl shaped transducer, the intensity measurements were made at 420 kilocycles per second, at power control levels four, five, and six, and at depths of 1/2, 1, 1-1/2, 2, 2-1/2, and 3 inches from the top of the liquid level. The intensity values ranged from 0.5 to 2.9 volts for all of the three power control levels. The intensity versus depth curves showed a dip in the middle which indicated that intensity was less at the center than at the periphery.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The information thus obtained was applied to the determination of the overall mass transfer coefficients in the countercurrent dialysis of a 0.24 N caustic solution in the presence and absence of ultrasonics using a cellophane membrane. All of the dialysis experiments were started at a temperature of 23 $\pm$ 1 °C. The overall mass transfer coefficients were calculated from the relationship:

$$W = U \times A \times \Delta C_{lm} \quad (1)$$

where:

W = weight of material passing through the membrane in unit time, gm/min

A = area of the membrane, sq cm

U = overall mass transfer coefficient, cm/min

ΔC_{lm} = logarithmic mean concentration gradient across the membrane, gm/ml

The values of the overall mass transfer coefficients calculated from equation (1) were: 1.59, 3.06, 4.15, 2.66, 2.26, and 2.29 centimeters per minute corresponding to the power control levels two, three, four, five, six, and no insonation, respectively. The results indicate that in general the values of the overall mass transfer coefficients are greater in the presence of ultrasonics than without it. The increase is attributed to the alternating compressions and tensions, and the micro-agitational action produced by ultrasonic waves on the water and caustic films on either side of the membrane.

Microfilm $3.70; Xerox $12.40. 285 pages.

THE DYNAMIC HEAT TRANSFER CHARACTERISTICS OF A CONTINUOUS AGITATED TANK REACTOR

(L. C. Card No. Mic 58-3865)

Robert Joseph Fanning, Ph.D.
The University of Oklahoma, 1958

Major Professor: C. M. Sliepcevich

In order that full advantage may be taken of the relatively recent advances in chemical plant process control analysis, the dynamic response of various types of processes and equipment must be known. A theoretical and experimental investigation has been made relative to the dynamic heat transfer characteristics of a continuous agitated tank reactor of 12-inch diameter. The geometry of this unit is very similar to many of those used in industry. This particular study is concerned only with the equipment dynamics displayed during the addition or removal of sensible heat and does not include the effects of an autothermic heat source. A thorough knowledge of the former is a prerequisite to the study of a similar system undergoing continuous exothermic or endothermic chemical reaction.

Dynamic response characteristics of the given equipment have been determined by transient and frequency response techniques. This entailed the design and construction of a sine-wave generator for imparting a sinusoidal function to the forcing process variable.

Data were taken for four different equipment arrangements in which fluids of widely varying physical properties were charged. Quantitative information was obtained demonstrating the effect on equipment dynamics of charge fluids with different physical properties. These effects are quite significant and must be taken into account in any theoretical analysis.

Concentrated experimental effort was devoted to a determination of reactor wall and coil phase lead effect. At all frequencies and amplitudes tested however, these effects proved to be too small for detection with the available sensing equipment.

An approximate general rule was experimentally established relative to the significance of reactor tank fluid turbulence on the dynamic response of this equipment type.

Response curves were developed showing the effect of coolant fluid flow conditions on the process transfer function during the removal of reactor fluid heat. Differences in response characteristics for various levels of coolant turbulence were shown to be measurable but probably not significant to overall closed-loop response.

A total of eleven different theoretical transfer functions were developed and comparisons were made with experimental data. Such comparisons made possible the recommendation of certain suitable procedures for developing transfer functions analytically, for use under similar process conditions. Microfilm $2.40; Xerox $8.40. 184 pages.

PERFORMANCE OF A SEMICONTINUOUS ION EXCLUSION COLUMN

(L. C. Card No. Mic 58-7732)

John Daniel Janicek, Ph.D.
University of Michigan, 1958

"Ion exclusion" is a method of separating electrolytes from non-electrolytes in aqueous solutions. In the column constructed for this investigation feed is introduced into the lower third of the column. As the feed flows down the column countercurrent to resin moving up the column, the resin selectively absorbs the non-electrolyte while excluding the electrolyte. Rinse water flowing down the upper third of the column desorbs the non-electrolyte from the resin and is withdrawn as product at a point above the feed position. The regenerated Dowex 50X8 resin is recycled to the bottom of the column.

This investigation studied the effects of major operating variables on the performance of a column having an inside diameter of 2.26 inches and an overall length of 8.5 feet. The feed rate (F) was varied primarily between 1600 and 3700 grams per hour; the product rate (P) between 1100 and 2600 grams per hour; the average resin velocity (v) between 1.1 and 2.8 inches per minute, equivalent approximately to between 1200 and 3100 grams per hour of liquid inside the resin (V). Besides the above operating variables, geometric factors (such as the locations and designs of the feed and product distributors) and the technique of moving the resin bed were also varied. A typical feed stock of 5 wt % glycerol (X_{Fg}) and 5 wt % sodium chloride (X_{Fs}) was used. The product concentration of glycerol is denoted by X_{Pg}. Sodium chloride concentrations were determined by titrating for chloride ions. Glycerol concentrations were determined from density measurements.

The results and conclusions include the following:

1. For a given feed stock, a given technique of moving the resin bed, and a given column geometry, the experimental results indicate the utility of expressing the performance as a relation between X_{Fg}/X_{Pg} and P/v with F/v as a parameter.

2. If the recycled resin is almost completely regenerated, the theory of column operation yields the following equation for predicting X_{Pg} as a function of the flow rates:

$$\frac{X_{Fg}}{X_{Pg}} \cdot \frac{m_{Lg}}{m_{Ug}} = \left[\frac{P}{m_{Ug}V}\right] \cdot \left[1 + \frac{1 - \frac{m_{Ug}V}{P}}{\exp\left[(1 - \frac{m_{Ug}V}{P})N_U\right] - 1}\right] \cdot \left[1 + \frac{1 - \frac{m_{Lg}V}{F}}{\exp\left[(1 - \frac{m_{Lg}V}{F})N_L\right] - 1}\right]$$

where

m_{Ug}, m_{Lg} = equilibrium distribution coefficients for the non-electrolyte (glycerol) in the upper and lower sections, respectively. The distribution coefficient is the ratio of the concentration of a component in the liquid in the resin phase to the concentration in the liquid surrounding the resin. (m_{Ug} = 0.57 and m_{Lg} = 0.70 in this investigation.)

$N_U = \frac{h_U}{H_{max}}$ (or $N_L = \frac{h_L}{H_{max}}$) = number of transfer units in the upper (or lower) section, whose length is h_U (or h_L).

H_{max} = Height of the overall resin phase Transfer Unit (HTU), assuming that the conductivity flow controller maintains zero net liquid flow between the feed inlet and the product outlet of the upper section. The evaluation of the HTU from data is critically dependent upon this liquid rate.

The above equation indicates that X_{Pg} may be greater than X_{Fg},

$$X_{Pg}, \text{ maximum} = X_{Fg} \cdot \frac{m_{Lg}}{m_{Ug}}$$

3. Dimensional analysis and the above theoretical results indicate that a relation between $\frac{X_{Fg}}{X_{Pg}} \cdot \frac{m_{Lg}}{m_{Ug}}$ and $\frac{P}{m_{Ug}V}$ with parameters of $\frac{F}{m_{Lg}V}$, technique of moving the bed, and column geometry may give a more general correlation for a given system than that indicated in item (1).

4. Values of H_{max} were computed from the data. H_{max} is believed to be conservative, but should be considered primarily as a correlating device rather than an estimate of the "true" value of the HTU. A value for H_{max} of about 15 inches was found to correlate 19 out of 25 experiments using various geometries and techniques of moving the bed. However, a value of about 22 inches was obtained when the length of the upper section was reduced. H_{max} became very large when the center section was made extremely short.

5. Concentration gradients were found to exist radially across the column. The radial profiles might explain some of the effects of column geometry and the technique of moving the bed on the performance of the column. Their existence indicates the desirability of extending the present investigation to columns of larger diameter to provide a broader basis for applying the results of this investigation to such columns.

Microfilm $3.55; Xerox $12.00. 273 pages.

CONDENSATION ON ROTATING SURFACE

(L. C. Card No. Mic 59-337)

Shamrao Srinivasrao Nandapurkar, Ph.D.
North Carolina State College, 1958

Supervisor: K. O. Beatty, Jr.

A centrifugal force field has been shown to be satisfactory for the continuous removal of condensate film and for maintaining higher rates of heat transfer from vapor to condensing surface than the gravitational force. This thesis presents data on a 5 in. diameter, rotating, horizontal, water cooled surface for the condensation of pure vapors of methanol, ethanol and Freon-113 at atmospheric pressure. Heat transfer coefficients were determined for each vapor at rotational speeds of about 400 to 2400 RPM by the use of thermocouples located in the rotating surface. Over this range of operation it was found that the coefficients for methanol, ethanol, and Freon-113 increase approximately as the square root of the rotational speed but had magnitudes of approximately 70% of the values predicted by the equation

$$h_m = 0.904\ (\omega)^{1/2}\ (K^3\rho^2\ \lambda/\mu\Delta)^{1/4}$$

which is derived by theory using Nusselt's assumptions. Data for ethanol were, in general, a few percent nearer theoretical than those for Freon-113 which in turn were a little better than those of methanol.

It is believed that the principal cause of the lower heat transfer coefficients is the effect of the vapor drag on the condensate film thus tending to increase it. This is consistent with the increased deviation observed for experimental results from the theoretical values as the rotational speeds were increased.

Since the range of fluid properties of the liquids used was sufficiently great, the following emperical equation is proposed for all pure vapors within the range of condensation rates of 5 to 45 lbs/hour and over a range of temperature drop (across the condensate film) of 20°F to 80°F.

$$h_m = 1.716(K^3\rho^2\ \lambda/\mu\Delta)^{1/4}\ (\omega)^{0.425}$$

or

$$h_m = 21.36(K^3\rho^2\ \lambda/\mu\Delta)^{1/4}\ (n)^{0.425}$$

Nearly 90% of the experimental results obtained in this work lie within $\pm$ 11% of the results predicted by this equation. Microfilm $2.00; Xerox $4.40. 85 pages.

MECHANICAL DEGRADATION OF DILUTE POLYISOBUTYLENE SOLUTIONS

(L. C. Card No. Mic 59-1197)

Ferdinand Rodriguez, Ph.D.
Cornell University, 1958

High speed rotation of smooth discs in dilute polyisobutylene solutions causes a decrease in viscosity average molecular weight, M_v. Polymer fractions of $M_v = 0.6$ to 4.0×10^6 as well as whole polymer of $M_v = 2.0 \times 10^6$ were investigated in eight solvents. The experimental data can be summarized in the equation

$$\log (M_v/M_1) = -n \log (\theta + C'')$$

where: $M_1 = M_v$ at $\theta = 1$,
θ = time in minutes,
n = a constant varying from 0.1 to 0.2 under conditions studied, and
C'' = a constant which often is negligible compared to θ.

The rate at which a polymer molecule for which $M_v = M$ degrades, in terms of the percent change in M per unit time, can be thought of as the probability of degradation for that size molecule. This rate or probability is proportional to $M^{1/n}$ and independent of initial molecular weight. The M which is reasonably resistant to degradation (degrades very slowly under test conditions) is proportional to disc speed to the -0.6 power in cyclohexane and in a 1:1 mixture of mineral oil and kerosene for speeds in the range of 700 to 11,000 rpm. Degradation decreases regularly when the concentration is decreased from 0.6 to 0.05 g/dl and when the temperature is raised from 25 to 60°C. In poor solvents (benzene, toluene), degradation is much more severe than in good solvents (cyclohexane, methylcyclohexane). Increased solvent viscosity causes a small increase in degradation. There appears to be no correlation of degradation with vapor pressure of the solvent.

A mechanism which is consistent with the findings of the present work includes distortion of polymer molecules into elongated shapes in a zone of orderly flow followed by entanglement and rupture in a zone of high turbulence where eddies moving in different directions subject the polymer aggregates to high stresses.

Microfilm $2.00; Xerox $6.80. 143 pages.

THE MEASUREMENT OF LIQUID DIFFUSION COEFFICIENTS BY MEANS OF A NEW CAPILLARY TECHNIQUE

(L. C. Card No. Mic 59-350)

Robert Rozett, Ph.D.
North Carolina State College, 1958

Supervisor: Dr. Edward Martin Schoenborn

Liquid diffusion coefficients have been determined for five partially miscible binary systems over a temperature range of minus 50°C to plus 25°C, by means of a new experimental technique. The method employed is convenient, relatively rapid, and has been shown to provide data of a high degree of precision.

The systems carbon disulfide-acetonitrile, carbon disulfide-methanol, carbon disulfide-nitromethane, n-heptane-methanol, and methylcyclohexane-methanol were chosen for study because each was miscible over the entire temperature range, and provided a sufficient degree of mutual solubility for ease and precision of analysis. For use in calculation of the diffusion coefficients and subsequent correlation of results, viscosities and solubilities were measured by standard techniques for each of the systems over the entire temperature range.

The equipment consisted of a capillary tube containing the solute material, a bath to contain the solvent liquid, and a precision cathetometer for measurement of the rate of mass transfer with time. The method requires that the fluids to be studied form two partially miscible layers, and the rate of movement of their interface in the capillary can then be employed as a measure of the mass transfer rate. The effects of the system geometry, rate of stirring of the bulk fluid, capillary tube diameter, and interfacial resistances were evaluated.

It was found that the method checked well with the results of other investigators for diffusion in the n-butanol-water system, with a maximum difference of less than fifteen per cent in the values obtained at 25.00°C. The necessary corrections for the minor system variables were found to be of small magnitude and were easily evaluated. The effect of increased temperature was to increase the diffusion coefficients, and it was found that when these variables were plotted on logarithmic scales a linear relationship resulted. The results were correlated by means of a function of the temperature (T), viscosity (μ), and diffusion coefficient (D) by means of an equation of the form

$$T/D\mu = aT^n$$

and it was found that the exponent n varied from 1.46 to 1.64. Comparison with meager data of other investigators indicates a range of exponent values from minus 1.0 to plus 2.5. The exponent is close to zero for ideal systems, but deviates greatly for non-ideal systems.

Microfilm $2.80; Xerox $9.60. 213 pages.

PHASE EQUILIBRIA AND LIQUID IMMISCIBILITY IN THE SYSTEM LITHIA-BORIC OXIDE-SILICA

(L. C. Card No. Mic 59-770)

Bommakanti Sri Rama Sastry, Ph.D.
The Pennsylvania State University, 1958

Adequate information on the phase equilibria in alkali borosilicate systems has been lacking so far. On the basis of optical microscopy, the existence of liquid immiscibility in such systems has been disclaimed. In the present investigation, the phase relationships in the systems Li_2O-B_2O_3 and Li_2O-B_2O_3-SiO_2 have been determined. Liquid immiscibility, noticeable under the electron microscope, has been shown to exist in lithium borosilicate glasses.

The methods used were: quench, DTA, optical and electron microscopy (replica and transmission methods), and x-ray and electron diffraction.

Eight compounds exist in the system Li_2O-B_2O_3 : L_3B ($L = Li_2O$, $B = B_2O_3$), L_2B, L_3B_2, LB, LB_2, L_2B_5, LB_3 and (probably) LB_4. Only LB and LB_2 melt congruently. L_2B, L_2B_5 and LB_3 possess a lower limit of stability.

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L_2B exists in two forms. The phase diagram for the binary system is presented.

A study of the cooling behavior and the behavior on reheating of forty-eight lithium borosilicate glasses containing one to twenty-six per cent (wt.) Li_2O showed the presence of three groups: clear glasses, glasses which developed opacity spontaneously, and glasses which developed opacity on reheating. The intensity of opacity depended on the melting or reheating temperature, the rate of cooling and the duration of reheating.

Electron microscope data of nine selected glasses are presented. The immiscibility was characterized by the presence of spherical particles (100 to 6700 a.u. in diameter) dispersed in the matrix glass. The size of the spheres varied with the heat treatment of the glass. The dispersed phase (less siliceous phase) was mechanically separable from the matrix glass (the more siliceous phase).

No ternary compound exists in the investigated portion of the ternary system. The joins L_2S-L_3B, LS-L_3B, LS-L_2B, LS-L_3B_2, LS-LB, LS-LB_2, LS_2-LB_2 and S-LB_2 exist; the existence of the joins S-L_2B_5 and S-LB_4 was inferred. The joins LS-LB, LS-LB_2 and LS_2-LB_2 showed a simple eutectic relationship. The liquidus curve of S-LB_2 showed a pronounced trough-like appearance, indicative of ternary immiscibility. The temperatures and approximate compositions of the ternary invariant points in the sub-systems LS-LB-LB_2 and LS-LS_2-LB_2 were determined.

The linear thermal expansion of nine glasses was measured. The development of immiscibility resulting from reheating a glass containing 2% Li_2O lowered the coefficient of expansion by 20%. The refractive index of glasses increased with the addition of Li_2O.

The nature of immiscibility and the phase relationships in this system have been compared with the corresponding aspects of the other alkali and alkaline earth systems to show the intermediate nature of the lithium borosilicate system. Microfilm $2.00; Xerox $6.80. 145 pages.

ELECTROCHEMICAL PREPARATION OF SOME AMINE-BORANE COMPOUNDS

(L. C. Card No. Mic 59-1187)

Richard Sterling Tinsley, Ph.D.
Virginia Polytechnic Institute, 1955

The purpose of this investigation was to study the preparation of some amine-borane compounds by the electrolysis of sodium borohydride in liquid amines.

This investigation was a study of the electrolysis of sodium borohydride in monomethylamine, dimethylamine, monoethylamine, n-propylamine, isopropylamine, n-butylamine, and pyridine between a mercury cathode and platinum anode. Conductivities of sodium and lithium borohydride in monomethylamine, dimethylamine, trimethylamine, monoethylamine, diethylamine, triethylamine, n-propylamine, isopropylamine, n-butylamine, di-n-butylamine, aniline, pyridine, pyrrole, pyrrolidine, and quinoline were determined.

The amine-borane compounds were separated from the electrolyte by distilling off the excess amine at low temperatures, extracting the product from the residue with diethyl ether, distilling off the ether, and purifying by distilling or recrystallizing the product from diethyl ether.

Monomethylamino-borane is the stable anode product formed, with a current efficiency of 64.8 per cent, from the electrolysis of sodium borohydride in monomethylamine at an anode current density of 0.236 amperes per square centimeter. The monomethylamino-borane compound melts at 48 to 49 °C and slowly decomposes in moist air.

Dimethylamine-borane can be prepared at a current efficiency of 62.5 per cent by the electrolysis of sodium borohydride in dimethylamine at an anode current density of 0.214 amperes per square centimeter. The dimethylamine-borane compound prepared electrochemically is a white crystalline solid that melts at 33 to 34 °C and slowly decomposes in moist air.

Monoethylamine-borane can be prepared by the electrolysis of sodium borohydride in monoethylamine but is unstable at 20 °C when removed from solution. Monoethylamino-borane is the stable anode product formed with a current efficiency of 54.3 per cent from the electrolysis of sodium borohydride in monoethylamine at an anode current density of 0.114 amperes per square centimeter. The monoethylamino-borane compound is a white crystalline solid that melts at 76.5 °C and slowly decomposes in moist air.

The n-propylamine-borane compound is the anode product formed with a current efficiency of 62.2 per cent from the electrolysis of sodium borohydride in n-propylamine at a current density of 0.129 amperes per square centimeter. The n-propylamine-borane compound melts at 39.7 °C and slowly decomposes in moist air.

Isopropylamine-borane is the anode product formed with a current efficiency of 60.0 per cent, from the electrolysis of sodium borohydride in isopropylamine at an anode current density of 0.089 amperes per square centimeter. The isopropylamine-borane compound is a white crystalline solid which melts at 60.3 °C and slowly decomposes in moist air.

The n-butylamine-borane compound is the anode product formed with a current efficiency of 52.9 per cent from the electrolysis of sodium borohydride in n-butylamine at a current density of 0.043 amperes per square centimeter. The n-butylamine-borane compound melts at 73 °C and slowly decomposes in moist air.

Pyridine-borane is one of the anode products formed with a current efficiency of 8.4 per cent, from the electrolysis of sodium borohydride in pyridine at a current density of 0.035 amperes per square centimeter. Pyridine-borane is not the primary anode product formed during this electrolysis. The pyridine-borane compound melts at 10 to 12 °C and slowly decomposes in moist air.

The specific conductances of sodium borohydride in monomethylamine at -6.0 °C, dimethylamine at 7.0 °C, monoethylamine at 15.4 °C, diethylamine at 29.0 °C, n-propylamine at 29.0 °C, isopropylamine at 28.4 °C, n-butylamine at 28.4 °C, pyridine at 28.4 °C, pyrrole at 28.6 °C, and pyrrolidine at 28.6 °C are: 25.8, 8.6, 8.6, 0.2, 6.9, 12.9, 0.4, 6.9, 0.3, and 1.3×10^{-3} reciprocal ohm-centimeters, respectively.

The specific conductances of lithium borohydride in monomethylamine at -6.0 °C, dimethylamine at 7.0 °C, monoethylamine at 15.4 °C, diethylamine at 29.0 °C, n-propylamine at 29.0 °C, isopropylamine at 28.4 °C, n-butylamine at 28.4 °C, pyridine at 28.4 °C, pyrrole at 28.6 °C, and pyrrolidine at 28.6 °C are: 85.9, 17.2, 19.8, 0.06, 10.3, 1.5, 2.3, 34.7, 0.3, and 0.5×10^{-4} reciprocal ohm-centimeters, respectively.

The specific conductances of sodium and lithium borohydride in trimethylamine, triethylamine, di-n-butylamine, aniline, and quinoline are less than 2.6×10^{-9} reciprocal ohm-centimeters. Due to the low conductances of sodium and lithium borohydride, electrolyses in these amines would not be possible.

Microfilm $2.50; Xerox $8.60. 190 pages.

ENGINEERING, CIVIL

STRESS STUDY OF A STEEL FRAMED DOME

(L. C. Card No. Mic 59-1257)

Jong Wan Choi, Ph.D.
University of Minnesota, 1958

Adviser: Paul Andersen

The primary purpose of this thesis is to investigate the stresses in the various members of a steel framed dome under different loading conditions, and to compare the theoretical stresses with the stresses obtained from observation of a model dome and finally formulate a guide about the elastic behavior of dome structure for use by engineers.

In order to investigate the stresses in a framed dome, a model was constructed with top ring and supported by a base ring, and having a radius of 3.98 ft. and 2 ft. rise. The model had twelve ribs and four intermediate belts.

If the joints of a framed dome are assumed to be frictionless, ther the stresses can be evaluated by statics. The necessary co nputations are quite simple. Since no practical structur can be built with only frictionless joints, the elastic behavior of a dome has become an important concern to structual engineers. The pattern of stress propagation and magnitudes of stresses, which were obtained by statics, due to single concentrated load have been questioned. Relatively little information is available with regard to analisis of domes by the elastic theory. This is partly due to complexity of the problem and also the enormous amount of computation involved.

The computations of stresses of the ribs and band members for symmetrical loadings by the elastic theory were made by assuming that the dome consisted of a series of intersecting arches hinged at the top ring and also at the supporting base ring, and at the intermediate connections elastic tie supports were assumed. For unsymmetrical loadings, an attempt was made to expedite the computations as follows: the single load is replaced by twelve of the same magnitude and direction applied through the band course on which the single load is located, and the dome is analysed as the arch mentioned before. Because framed domes have in the past often built without diagonals, particular attention was paid to the behavior of the model with and without diagonals.

The foregoing analyses and observations lead to the following conclusions:

1. For the symmetrical loadings, the dome can be designed satisfactory on the assumption of articulated joints.
2. For the single concentrated load, the stresses in the various members below the loaded joint do not become nearly as great as the results by statics indicate.
3. The dome may be built without diagonals provided the joints are reinforced for proper stiffness.
4. In space structures like the dome, the assumption of hinged joints should be made only for symmetrical loads.

Microfilm $2.80; Xerox $9.60. 214 pages.

THE USE OF ULTRASONICS IN THE MEASUREMENT OF SUSPENDED SEDIMENT SIZE DISTRIBUTION AND CONCENTRATION

(L. C. Card No. Mic 59-1263)

Gordon Hans Flammer, Ph.D.
University of Minnesota, 1958

One of the greatest needs in the study of the mechanics of sediment motion in a flowing stream is adequate instrumentation. The purpose of this study is to develop theoretically and experimentally a method for measurement of sediment size distribution and concentration utilizing an electronic device--an ultrasonic transducer.

The theoretical study covered the following principal items:

1. An extension of existing attenuation relations for a sonic beam passing through a suspension of particles of uniform size to include parameters describing size distribution, thereby obtaining the attenuation-size distribution relationship for mixtures. The size distribution parameters are for a log-normal distribution, i.e., distribution which plots as a straight line on log-probability paper.
2. The use of frequency as a variable for the determination of the size distribution parameters of the mixture.

The experimental program included the following phases:

1. Verification of the theoretical concepts listed above.
2. An experimental study of the unknown attenuation relation for uniform sizes in the transition region between the scattering loss and diffraction loss ranges --in this region and basic assumption that the particles are rigid is not valid.
3. A preliminary study of the effects of sediment properties on the attenuation relation.

The method developed shows considerable promise. Its accuracy is reasonably good and can be improved. Two distinct advantages of the method are its speed of measurement and its apparent adaptability to automatic and continuous operation.

The study covered only the sieve range but the method could be extended to subsieve sizes. Other distributions than the log-normal could be used.

Since the relations for attenuation of ultrasound and light are practically identical, the approach seems equally adaptable for use with a turbidimeter in which the wave length of light may be varied.

Microfilm $2.00; Xerox $4.00. 74 pages.

DUST PROPERTIES IN RELATION TO DUST COLLECTION

(L. C. Card No. Mic 59-759)

Bernard Gutterman, Ph.D.
The Pennsylvania State University, 1958

This research was a basic study of some of the physical properties of dust suspensions and dust layers and the relation of these properties to dust collection. If the behavior of dust suspensions and dust layers in a collector was known in some detail, costly trial and error designs, long developments, and faulty applications of dust collectors might be avoided. It was the intent of this investigation to establish the relationship between the physical properties of dust and critical pickup or entrainment velocity and to elucidate the mechanism or mechanisms responsible for the backmixing of dusts. For the latter, relations between the physical properties of dust and the distribution of dust concentration in a turbulent gas flow along a collecting surface were investigated.

A portion of the investigation included analyzing those physical properties of dusts which determine the shear stresses or associated velocities necessary to pick up motionless particles from a wall or a dust layer. Among the properties investigated were internal friction or grain interlock, surface friction, cohesion of the dust, particle size and particle density. Materials tested were sand, glass, cork, tin, carborundum, and fly ash.

Another portion of the study was concerned with predicting concentration gradients due to backmixing by turbulent diffusion. Such variables as particle density and size were investigated along with the turbulent intensity of the gas stream.

A new mechanism of backmixing, backmixing due to bounce, was identified and has been investigated. The mechanism of bounce appears to be exclusively associated with dusts. In this study, the properties investigated were particle size, particle shape, density, and dispersion of the angle of rebound.

Equipment was specially developed or adapted for use on a laboratory bench scale for determining the desired physical properties.

Theory predicts quite well the shear stresses and velocities which accompany pickup from a wall or particle layer. Of particular note is the fact that the velocities or shear stresses can be predicted from a few simple bench top experiments on the dust in question and a knowledge of flow conditions in the system.

Backmixing by turbulent diffusion occurs for small particles if the proper turbulence conditions exist. If the Weiss-Longwell criterion for diffusion produces a diffusion ratio close to unity, backmixing by turbulent diffusion can be expected. The concentration gradient can be predicted with a fair degree of accuracy if the velocity profile is known and one point of concentration.

Bouncing of the particles in a gas suspension would seem to govern the condition of backmixing in the case of larger particles. A concentration field, based on the normal distribution of bounce angle and model data, can be predicted rather accurately if one point of concentration is known.

While all of the proposed theories for this work have been developed for simple cases, modifications can be made for their application to more complex systems.

Microfilm $2.00; Xerox $6.00. 121 pages.

A COMPARISON OF THE BENDING MOMENTS, SHEARS AND DEFLECTIONS FOR SUSPENSION BRIDGES WITH CONTINUOUS AND TWO-HINGED STIFFENING TRUSSES

(L. C. Card No. Mic 59-549)

Govindappa Nallakrishnan, Ph.D.
University of Illinois, 1958

The investigation compares the maximum moments and deflections at the tenth points of the side spans and main spans of seven suspension bridges: 1st, as designed, with two-hinged stiffening trusses, and 2nd, with continuous stiffening trusses having the same depths and moments of inertia as the original two-hinged stiffening trusses. It also compares maximum shears and grade changes at critical sections.

The suspension bridges compared varied in main span from 735 feet to 1447 feet. Ratios of side span length to main span length varied from 0.296 to the normal 0.500. Two of the seven bridges were theoretical designs and five were actual bridges which have been built.

As was to be expected, the comparisons showed that the continuous stiffening trusses had substantially smaller deflections in general than the two-hinged stiffening trusses having the same depths and moments of inertia. In order to arrive at some idea as to what moments of inertia would be required for the two-hinged stiffening trusses to have deflections no larger than the continuous stiffening trusses the average maximum deflections in side spans, main spans and for the bridges as a whole were computed. These were compared and by a method of extrapolation moments of inertia were established that would make the average maximum deflections for the two-hinged stiffening trusses the same as those of the continuous stiffening trusses which had moments of inertia the same as the original designs.

In order to obtain the data sought it was necessary to make three analyses for each bridge for each function compared. As a first step influence lines for the horizontal component of cable tension were developed for each of the seven bridges for each of the three analyses required. The ordinates to these influence lines were recorded in tables and diagrams.

The influence lines for horizontal component of cable tension enabled the calculation of the maximum moments at the tenth points of the side spans and the tenth points of the main spans for each of the seven bridges and for each of the three analyses required to secure the data sought. The maximum moments found were recorded in tables and diagrams.

The same procedure was followed for maximum deflections at the tenth points of the side spans and the tenth points of the main spans and the data secured recorded in tables and diagrams.

Maximum shears at critical sections were also computed for each of the seven bridges studied and for each of the three analyses required. The results were recorded in tables and diagrams.

As grade changes are considered by some authorities as a measure of the acceptability of a suspension bridge the maximum grade changes were determined at critical sections for each of the seven bridges for each of the three conditions under which analyses were made and the comparative grade changes were recorded in tables.

The large number of analyses necessary to obtain the

data recorded in the investigation would have been impossible without the many tables and diagrams presented in "A Partial Influence Line Procedure for Suspension Bridge Analysis by the Deflection Theory," a thesis presented by Jacob Karol in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Engineering in the Graduate School of the University of Illinois in 1938.

Dr. Karol's kindness in allowing the use of his material and his encouraging review of the author's work are gratefully acknowledged.

Microfilm $2.05; Xerox $7.20. 153 pages.

THEORY AND DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS

(L. C. Card No. Mic 58-2122)

Daryl B. Simons, Ph.D.
Colorado State University, 1957

Statement of the Problem

The design of stable channels has been the object of considerable interest and research during the past four decades. Two design concepts have been developed that are rather widely accepted currently.

1. The tractive force theory.
2. The regime theory of India.

These theories are unfortunately only applicable to a limited range of design conditions in the quantitative sense. In order to broaden their scope and possibly reduce them into one general comprehensive and complete theory a field study of stable irrigation canals was undertaken with the following specific objectives in mind.

1. To investigate, expand and possibly improve the regime theories as developed in India.
2. To investigate, expand, and possibly improve the tractive force method of stable channel design.
3. To relate the regime and tractive force theories insofar as possible.

Procedure

Data pertinent to the investigation of channel stability were collected from 24 stable reaches of irrigation canals. These data included: the discharge, water surface slope, shape measurements, velocity distribution, samples of bed and bank material, armour coat samples, samples of suspended sediment, samples of the total sediment load when it was feasible to obtain them, the configuration of the channel bed, the type of natural bed and bank material, the extent and type of bank vegetation, the temperature of the water and photographs of each reach when empty and at full supply. These data collected from the field were augmented by utilizing canal data collected by other investigators. That is, additional data were utilized from:

1. The Punjab canal systems of India.
2. The Sind canal systems of India.
3. The Imperial Valley canal systems of California.
4. The San Luis Valley canal systems of Colorado.

Results

As a result of the investigation based on all of the preceeding data the regime and tractive force theories were expanded to apply to the design of:

1. Canals formed in coarse non-cohesive material (charge = 500 ppm).
2. Canals possessing sand beds and slightly cohesive to cohesive banks (good results are obtained when charge is greater than 500 ppm).
3. Canals formed in sandy materials (charge = 500 ppm).
4. Canals with cohesive beds and banks (charge = 500 ppm).

Considering a combination of regime and tractive force concepts it is recommended that equations of the regime type relating such variables as width and depth with discharge should be used to establish the dimensions of canal cross-sections. The proper slope of channel can be estimated by either the regime relations or the tractive force relations as developed with approximately equal accuracy.

Conclusions

The regime and/or tractive force theories as modified by and presented in this dissertation are recommended as an improved method of designing stable channels in alluvial material where the magnitude of sediment load is not excessive. The recommended design relations have been applied to typical design problems.

The major limitations of the proposed design methods are:

1. The absolute effects of sediment load on channel stability have not been completely established.
2. Slope of channels can not be estimated with the desired accuracy in all cases.

Studies have been proposed that should reduce the significance of the foregoing limitations.

Microfilm $5.35; Xerox $18.80. 419 pages.

NUMERICAL INTEGRATION FOR ONE-DIMENSIONAL STRESS WAVES

(L. C. Card No. Mic 59-581)

Rodney Howe Smith, Ph.D.
University of Illinois, 1958

A dynamic analytical model is developed to solve approximately the problem of one-dimensional stress wave propagation in a wide variety of materials. Primary interest is in visco-elastic materials, but materials which have purely elastic or nonlinear resistances as well as nonprismatic bars of material are considered.

Since the lateral motion of the particles in the bar is neglected, this method is restricted to cases in which the lateral strains are prevented or in which the lateral dimensions are very small when compared with the longitudinal dimension and wave length.

The continuous mass of the bar is lumped into finite masses which are connected by combinations of weightless springs and dashpots representing the elasticity and viscosity of the system. The force, or pressure pulse, is placed on the end mass, and the response is computed by the use of the β-integration method, a timewise step-by-step numerical integration by successive approximations of the acceleration of each mass.

Perfectly elastic materials are considered by the use of a model with elastic springs between the masses. Delayed rise times and spurious oscillations, caused when the rise time of the pulse is too short, are very obvious when the rise time is less than two-thirds the shortest period of vibration. The elastic model is used to solve the classical problem of a rigid mass striking the free end of an elastic bar which is fixed on the other end both for the standard size time interval and for a choice of parameters which affords a "trick" solution with answers almost exactly equal to the exact theory.

The classical visco-elastic models, the Voigt, Maxwell, and standard linear models, are examined for use in this thesis, but a new visco-elastic model, the Newmark model, is obtained by inserting a mass between the auxiliary spring and Voigt element of the standard linear model. The solution of the resulting second order differential equation is accomplished by the University of Illinois Digital Computer (Illiac). Incorporated in the computer code are a number of features: the relative damping already described, absolute damping, Coulomb damping, strain rate effect (adjustment of the yield stress depending on the rate of straining), and linear, or multi-linear springs with elastic recovery.

A number of problems are computed to determine the effect of variation of the model parameters on response. The results of this variation are presented in a series of figures in which the parameters have been so chosen as to compute the attenuation of the air induced blast wave occurring in one dimension only of a large soil mass. The method is very flexible in use since the spring stiffness, dashpot viscosity, and mass size of each element may be varied in order to represent prismatic or nonprismatic bars possessing a wide range of attenuation.

By the use of a terminating dashpot derived from the electrical analog of transmission line termination, the finite length model previously described is made to approximate an infinite length system.

The usefulness of the model analysis is verified by comparing the response of the model under impact loads to experimental results in copper wire and Ottawa sand specimens.

The problem of spatial dispersion of a plane wave approximation to an atomic blast wave in a homogeneous, elastic, isotropic, and massless half-space is considered in the Appendix. This solution is presented to give an idea of the effects of dispersion. This dispersion adds to the one-dimensional attenuation of an air-induced blast wave which is transmitted through soil.

Microfilm $2.00; Xerox $7.00. 149 pages.

ENGINEERING, ELECTRICAL

SYNTHESIS OF ACTIVE NETWORKS WITH NEGATIVE IMPEDANCE CONVERTERS

(L. C. Card No. Mic 58-5397)

Robert Tien Wen Chien, Ph.D.
University of Illinois, 1958

The Linvill configuration is used to synthesize second-order, non-positive-real, driving-point functions. Synthesis is accomplished by the use of a surplus factor. With the arbitrariness of the surplus factor, one is able to control the driving-point function. The existence of the solution in all cases is demonstrated and the minimum number of elements property of the solution is proved. It is shown that only five elements are required besides the negative impedance converters (NIC). RC networks are used in some cases and RL networks are used in the remaining cases.

The synthesis of a transfer function together with the driving-point function is accomplished by application of Cauer's method of partial removal of poles. Useful results are obtained in synthesizing the transfer voltage ratios with different terminations, including the case of open output terminals. The conditions of realization are obtained and given in terms of coefficients.

The method used is further extended to realize all three functions. Necessary and sufficient conditions are found for three functions to be a realizable set. The synthesis itself is carried out in the same manner as in the previous cases.

For higher order functions, a procedure is outlined to find the desired pole positions by cut and try, for the synthesis of a driving-point function, or a driving-point function together with a transfer function.

The synthesis of complex zeros of transmission requires a configuration other than the simple one that has been used thus far. The proposed configuration is the bridged NIC network. In this new configuration, the important feature is the presence of feedback. Since there is a common ground for both the input and the output, the over-all short-circuit admittances are the sums of the short-circuit admittances without the bridge and the admittance of the bridging element. Any pair of complex zeros may be synthesized with this network with a small number of elements. The same approach will also realize zeros on the real axis in the right half plane.

Nodal and mesh equations are modified to treat networks with negative impedance converters with a few simple rules. Microfilm $2.00; Xerox $3.80. 68 pages.

SENSITIVITY OF ACTIVE NETWORKS TO VARIATIONS IN INTERNAL PARAMETERS

(L. C. Card No. Mic 59-1437)

Edward Maxwell Davis, Jr., Ph.D.
Stanford University, 1959

Supervisor: J. G. Linvill

An important consideration in the design of an amplifier is the extent to which the amplifier's performance can

be desensitized to changes in its active elements. In this report the three possible methods of achieving gain constancy despite changes in the parameters of a linear network are described. The sensitivity of the amplifier's gain to parameter variations is mathematically defined both for the case of differential changes in elements and for the case of large changes. The over-all gain of a linear circuit is shown to be a bilinear transformation of any internal element. The conditions necessary for amplification to be independent of changes in the active elements are presented in terms of the coefficients of the bilinear transformation and also in terms of circuit (or system) parameters. The sensitivity of the amplification of a linear network to changes in an internal two-terminal element is proportional to the impedance mismatch existing between that element and the remainder of the circuit. A measure, related to mismatch in the two-terminal case, is given which is proportional to the sensitivity to variations of transfer parameters.

A practical method of obtaining a very small sensitivity to parameter variations is the use of multiple-loop feedback in amplifiers. Methods of designing multiple-loop amplifiers are presented. An improvement factor is defined which measures the superiority of the performance of the multiple-loop amplifier over a single-loop amplifier using the same active devices. To illustrate the design procedure a multiple-loop transistor amplifier design is given in the text. Measurements of the characteristics of this amplifier provide experimental verification of the theory.

Although the emphasis of this report is on circuits using transistors, the results are presented in a form applicable to circuits employing any linear active device. In particular, all discussions are carried through using both transmission models (block diagrams or flow graphs) and two-port models.

Microfilm $2.30; Xerox $8.00. 173 pages.

A RADAR SYSTEM BASED ON STATISTICAL ESTIMATION AND RESOLUTION CONSIDERATIONS

(L. C. Card No. Mic 59-1462)

Bernard Elspas, Ph.D.
Stanford University, 1955

A novel form of radar system is derived from fundamental considerations of statistical estimation theory. The method of maximum likelihood is applied to the estimation of echo signal parameters on the basis of data received in the presence of additive Gaussian noise.

The form of the transmitted signal is dictated by considerations of resolution in range and velocity, together with ease of generation and demodulation. Specifically, the transmitted signal is a particular kind of phase-modulated wave for which the carrier phase is permitted to assume only two discrete values differing by 180° (phase-reversal modulation). Special modulation functions of this type, optimum in regard to range resolution, are determined by group-theoretic methods. These special functions (termed "pseudo-random functions") are shown to possess unusual statistical and group-theoretic properties which make them of interest also for communication situations (redundant binary coding).

The resulting radar system employs synchronous detection with quadrature-phased local carriers for the recovery of the modulation, and uses a form of North filter to perform a cross-correlation of the demodulated signal with a stored replica of the transmitted modulation. Consideration is given to the design and engineering feasibility of the unconventional features of the system.

The suitability of a system of this type to military applications is analyzed from the point of view of its engineering and tactical advantages in certain situations.

Microfilm $2.15; Xerox $7.60. 161 pages.

EFFECTS OF TEMPERATURE TRANSIENTS IN OXIDE COATED CATHODES

(L. C. Card No. Mic 59-1267)

Carl William Glewwe, Ph.D.
University of Minnesota, 1958

Adviser: W. G. Shepherd

The thesis describes an experimental investigation of oxide coated cathodes in which the effects of step temperature changes on the saturated pulsed emission are determined. It was found that an increase in temperature resulted in an initial increase followed by a relatively slow decrease while a temperature decrease gave the same results except for a reversal of sign. The time required to reach equilibrium varied from about 1 to 25 hours and increased as temperature decreased. All cathodes were equimolar barium-strontium oxide based on an alloy of nickel containing 0.2 percent magnesium. Cathode emission is defined as the current density where the current-voltage curve falls 20 percent below the three-halves power law. This value was measured by applying a three microsecond sawtooth voltage pulse between anode and cathode and using a special circuit to display the current-voltage curve on the face of an oscilloscope. Cathode temperatures ranged from 943°K to 1097°K with step variations from 32°K to 131°K. The slow variations in emission were of the order of 5 to 15 percent. Cathode conductance was also measured and appeared to be proportional to emission.

Two types of cathode poisoning encountered during the investigation also are discussed. Anode poisoning, the deactivation of the cathode by dissociation of cathode evaporation products collected on the anode, was especially noticeable with nickel anodes. The use of titanium anodes reduced the poisoning and hot titanium anodes further reduced the effect. A decrease in emission also was observed when the cathode remained at room temperature preceding an emission measurement.

The number of donor centers in the oxide is calculated by assuming a model for the activation of the oxide by the magnesium in the base metal and by minimizing the Helmholtz free energy function at the surface of the oxide particles. The result is used to calculate the following new emission equation. $J_S = B_o T^{\frac{1}{2}} \exp(-e\phi^*/kT)$ This equation is an explicit function of temperature and the work function, ϕ^*, is the sum of at least four terms. Some of these terms are functions of the base metal and some depend on the oxide itself. The value of each term is calculated from appropriate measurements from this and other experimental investigations. The precise nature of the donor center is

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

not specified although certain properties are assumed. The new equation also determines the temperature dependence of the work function, ϕ, in the Richardson-Dushman equation. For one experimental tube this was found to be 2.46 x 10^{-4} electron volts per degree.

The proposed theoretical model is used to explain the main features of the experimental results. The essential result is that the emission depends on the number of donor centers which is a function of both the oxide and the base metal. The equilibrium number of centers decreases as temperature increases and the time to reach a new equilibrium following a temperature change results in the slow emission variation in a direction opposite to that of the temperature change.

Microfilm $2.00; Xerox $4.00. 71 pages.

SOME BASIC PROBLEMS IN THE DETERMINATION OF THE DIRECTION OF ARRIVAL OF RADIO WAVES

(L. C. Card No. Mic 59-521)

Edgar Clay Hayden, Ph.D.
University of Illinois, 1958

The most persistent and difficult problem in radio direction finding has been measurement of the direction of arrival of waves under circumstances where multipath propagation of the signal is possible. In the HF band, the ionosphere plays a predominant role in the propagation of radio waves, and in this region several mechanisms exist which promote splitting of a radio signal into numerous components. Under suitable circumstances, several of the components will arrive at a receiving site, each over its own path, and each with its own direction of arrival.

It would be of value to have a more thorough knowledge of the characteristics of the individual signal components. The principle purpose of this investigation was the experimental evaluation of some of these characteristics for signals traveling in an east to west direction between particular fixed transmitting and receiving sites separated by 450 km. Of particular interest were the directional characteristics of signal components propagated in the various modes.

By the employment of a special double-pulse transmitted signal, and receiving equipment capable of measuring and displaying simultaneously bearing, polarization, and mode structure, it proved possible to "take apart" a multicomponent arriving signal and study the behavior of its components. The frequency used was 5155 kc.

A substantial amount of information was obtained on the short-time and the long-time directional fluctuations of signals propagated in two modes, the one-hop sporadic E-layer mode and the one-hop F-layer mode, including information on the behavior of the individual magneto-ionic components of the latter mode. In addition, a smaller amount of information was obtained on the behavior of signals propagated in three other modes.

One of the more surprising observations was the relative stability of the directional properties of signals propagated in the sporadic E mode. Directional variations, both on a short-time and on a long-time basis, were the least for signals in this mode. The two magneto-ionic components of the F-layer mode were next in order of stability, but were appreciably more variable. In addition these latter components showed persistent deviations from the great circle bearing, the ordinary component arriving, on the average, about 9° to the north, and the extraordinary component, on the average, approximately 4° to the south.

Some observations were also obtained on widely-deviated auroral and sporadic E modes, both on the system described above and on a wide-aperture Wullenweber direction finding system.

Microfilm $2.30; Xerox $8.00. 175 pages.

A SEMICONDUCTOR-DIODE PARAMETRIC AMPLIFIER AT MICROWAVE FREQUENCIES

(L. C. Card No. Mic 59-1442)

Kenneth Lee Kotzebue, Ph.D.
Stanford University, 1959

Supervisor: H. Heffner

Recently, great interest has been aroused in a class of amplifying and frequency-converting devices often called variable-parameter or parametric devices. The main reason for this interest is that these devices hold promise of having low-noise properties at microwave frequencies. In this paper such a microwave parametric amplifier is examined both theoretically and experimentally. The usual small-signal theory of "three-frequency" parametric amplifiers is presented and extended, yielding information regarding the large-signal behavior as well as the small-signal performance. Expressions are developed for the small-signal gain, bandwidth, and noise figure; and approximate large-signal expressions are developed for the saturated power output, the required pump power to start oscillation, the power output as an oscillator, and the efficiency as an amplifier and oscillator. Assuming that the variable-reactance element used in the parametric amplifier is a back-biased semiconductor diode, minimum diode characteristics are obtained in terms of the diode "Q" and fractional capacitance swing.

Extensive measurements were made of the microwave characteristics of the type of diode used in the experimental parametric amplifier, with emphasis on the measurement of series resistance. For this diode, a welded-contact germanium diode, the series resistance was a function of frequency, decreasing at a rate of nearly 3 db per octave over the frequency range of 500 Mc to 3,500 Mc. These measurements indicate that the germanium diode may be useful in parametric amplifiers at frequencies much higher than those predicted on the basis of low-frequency measurements.

The experimental amplifier which was constructed consisted essentially of a rectangular microwave resonant cavity, with the diode placed in the center between two posts. The cavity was simultaneously resonant at 1.23 kMc, the signal frequency; 2.25 kMc, the idle frequency; and 3.48 kMc, the pump frequency. At 15 db gain, the amplifier had a bandwidth of 0.55 Mc, and a noise figure of approximately 6 db. The required pump power was of the order of 10 mw and the saturated power output was about 1 mw. While the noise figure was not exceptionally low,

the results indicate that thermal noise is the only significant source of noise, thus giving promise that one can obtain substantially lower noise figures. In all cases agreement between theory and experiment is good.

Microfilm $2.00; Xerox $4.20. 77 pages.

COUPLING NETWORK DESIGN USING DISCRETE-FREQUENCY DATA

(L. C. Card No. Mic 59-1443)

Panos Aristides Ligomenides, Ph.D.
Stanford University, 1959

Supervisor: D. F. Tuttle

The problem of broad-band coupling-network design is one of primary practical importance in electrical engineering. This report is concerned with the derivation of a method for such network design. The design problem may be stated as follows: "To design a two-port coupling network that presents some prescribed input impedance, Z_{in}, when terminated in a prescribed load impedance, Z_L, both input and load impedances being described over a certain band of frequencies." A method for the design of practical lossless ladder networks, based on a point-by-point matching in the frequency domain, is described. The load-terminating impedance and the desired input impedance to the coupling network when so terminated, are described in the data by values at a number of discrete frequencies (as might result from source and load measurements). The values of the electrical elements in the coupling structure are related by convenient means to its matching properties. A simple design procedure is developed, for two- and three-element ladders, by minimizing the mean-square error in the desired input admittance or impedance at the frequencies considered in the data. The minimization procedure is simple enough when three variables (electrical elements) are involved--and for most practical cases two- and three-element networks are satisfactory on account of their simplicity. (As the complexity of the ladder coupling network increases, the procedure encounters considerable computational difficulty.) Applications to the design of broad-band transistor amplifiers and antenna matching are illustrated.

Microfilm $2.55; Xerox $9.00. 196 pages.

THE INFLUENCE OF ELECTRON BEAM BEHAVIOR ON KLYSTRON EFFICIENCY

(L. C. Card No. Mic 59-1453)

José Thomaz Senise, Ph.D.
Stanford University, 1959

This investigation aims, through direct experiment, at a better understanding of the behavior of velocity-modulated electron beams, with emphasis on those factors which influence klystron efficiency. The conditions of operation are those which are usually not covered by any theory but which are typically encountered in high-power klystron amplifiers. The experiments were performed with an "rf beam analyzer" previously devised and used by D. K. Winslow at Stanford. The analyzer is essentially a pulse-operated, magnetically-focused, S-band two-cavity klystron amplifier, with shielded gun, designed on the basis of actual tube practice. The device differs from a conventional klystron in that it has a continuously variable drift length and a beam-scanning arrangement which permit complete cross sections of the beam to be obtained; these show both the dc and the rf radial current density distributions at any given drift distance.

The main results of this study are the following:

1. The drift distance corresponding to maximum power output was found to be a function of signal level and magnetic focusing field configuration, other parameters being held constant. This set of data did show, in particular, very good agreement between small-signal experiments and space-charge-wave theory.

2. The efficiency of the tube could be increased, at any given drift length, by means of changes in magnetic field and load. Thus, by successive adjustments, it was possible to obtain substantially constant power output for a wide range of drift lengths. Brillouin-field focusing proved satisfactory for operation at low signals, but at high signal levels other focusing fields, and particularly fields with intensity increasing with distance, gave best results.

3. Optimum conditions were found to be broad. Two-to-one variations of load, 8-percent variation in current in the main focusing coil, and drift-tube length variation between 47 and 65 degrees, taken separately, did not alter the maximum power output of the tube by more than five per cent.

4. Some of the factors which may affect the efficiency of the tube under different focusing conditions were found through detailed beam analysis. These factors appear to be: a) The relative diameter of beam and drift tube and particularly the relative position of scallop minima and output gap. b) The differences in the way the rf current distributes itself on the beam cross section. c) The differences in the way rf current and electric fields interact in the output gap.

While it is difficult to draw precise conclusions from the data presented in this report, it seems to be generally true that at high signal levels the best beam is not necessarily the one of highest rf content but rather is the beam that is best able to transfer its rf content to the output load.

In the experiments described, optimum performance occurred when the focusing conditions and the drift distance were such that the beam without rf had a relatively small diameter in passing through the output gap. With rf applied, the beam radius became larger but was still much smaller than the gap radius. With Brillouin flow, on the other hand, the beam was found to be larger than in the optimum case in passing through the gap, and there was a greater loss of current in the gap as a result of the interaction with the rf field.

Thus, although a detailed analysis of the rf current content of the beam indicated a higher content with the Brillouin-focus beam, this beam was much less efficient for large-signal operation than the beam obtained with the optimum magnetic field.

Microfilm $2.00; Xerox $5.20. 101 pages.

A STUDY OF A VHF-UHF BAND-PASS FILTER EMPLOYING STRIPLINES AND CONVENTIONAL VHF CAPACITORS AS CIRCUIT ELEMENTS

(L. C. Card No. Mic 59-1154)

Alva Cress Todd, Ph.D.
Purdue University, 1957

Major Professor: Robert P. Siskind

Classical filter theory is employed in the study of symmetrical band-pass filters using striplines and capacitors. A filter section consisting of one stripline and four capacitors in a Pi configuration is converted to a lumped-constant lattice equivalent. Critical frequencies in the ratio of the lattice arms define the pass band and permit the writing of design equations for the capacitors in terms of center frequency, pass-band width, and stripline length and characteristic resistance. Optimum stripline dimensions are determined from an investigation of section image resistance as a function of stripline length and section half pass-band width. Expressions are found for the transmission characteristics of two and four-section symmetrical band-pass filters using synchronously tuned sections for equal source and load resistance values. Insertion loss and phase shift is computed for three families of four-section filters. Slightly unsymmetrical Chebishev type insertion loss behavior is obtained over a pass-band range of 9.4 to 22.2 per cent of center frequency. A method is presented for the selection of the ratio of section half pass-band widths for an allowable pass-band ripple value and a desired skirt characteristic. Verification of the analysis and design procedure is obtained by the construction and testing of an experimental four-section UHF band-pass filter.

Microfilm $2.00; Xerox $4.80. 94 pages.

QUADRATURE SIGNAL FUNCTIONS AND THEIR APPLICATIONS

(L. C. Card No. Mic 59-1460)

Donald Kessler Weaver, Jr., Ph.D.
Stanford University, 1959

Any signal or time function can be expressed in terms of two low frequency signals called quadrature functions. Each of these functions occupies the portion of the spectrum from 0 to W/2 where W is the bandwidth of the original signal. These functions form the basis for a rigorous definition of the amplitude and phase functions of any signal, broadband or narrow-band. They also find many other uses as a "tool" in signal analysis and modulation theory.

The quadrature signals are easily generated. Many operations on signals can be carried out on their quadrature function. For instance, band-pass filter requirements can be realized with low-pass filters applied to the quadrature signals. A signal is easily regenerated from its quadrature functions. Also a frequency translated version of the original signal is just as easy to generate. This is the basis for a new method of single-sideband generation and detection. Applications to other modulation and detection operations are possible.

Microfilm $2.05; Xerox $7.20. 153 pages.

ENGINEERING, HYDRAULIC

A STUDY OF ROUGHNESS IN ALLUVIAL CHANNELS

(L. C. Card No. Mic 58-5730)

James R. Barton, Ph.D.
Colorado State University, 1958

Experiments for this study were done in a four-ft wide, variable slope flume which was 70 ft long. Using natural river sand with a mean diameter of 0.18 mm, thirty-six different discharges were put through the flume under varying conditions of slope and depth. The experiments covered only a moderate range of roughness conditions and the findings can be briefly summarized.

In summary, this dissertation presents three main aspects of the alluvial roughness problem. First a plot is submitted as a method for determining the regime of roughness which exists in an alluvial non-cohesive channel. A method of evaluating the magnitude of the roughness coefficient is then presented. The last subject covers a rather extensive description of the various roughness regimes which occur in alluvial channels under varying conditions of flow and sediment size.

Using data from numerous sources, two plots were prepared. The first plot is a plot of $\frac{V_*}{w}$ against $\frac{V_{*d}}{\nu}$ with $\frac{wd}{\nu}$ as a third variable. From this plot the regime of roughness can be determined for a given sediment size at various values of either $\frac{V_*}{w}$ or $\frac{V_{*d}}{\nu}$. For flume data, this plot is reasonably reliable and a preliminary study indicates that it may be made to apply to river conditions also.

The second graph was designed to predict the magnitude of the roughness coefficient and this is a plot of $\frac{n}{n_o}$ against $\frac{\tau_o'}{\tau_c}$ where

- n - roughness coefficient of the bed
- n_o - defined by the equation $n_o = 0.0166\ d^{1/6}$
- τ_o' - shear velocity associated with the mean sand grain size
- τ_c - critical shear as determined from Shield's curve

Only two sets of data were included in this graph because most of the available data cover a range of roughness which is too narrow to be significant on this plot. More data covering the entire range of channel roughness are needed to expand this plot so that it can be made more general in scope.

In addition to the two plots, a description is made of the various regimes of channel roughness. Each regime of roughness is characterized by certain roughness patterns and these are presented most effectively in the form of a list.

1. Plane bed regime is characterized by no sand waves and no sediment movement.
2. Ripple regime has a systematic and fairly uniform roughness pattern.
3. Dune regime has a randomly distributed roughness pattern with the dunes being larger and more

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irregular in shape and size than the ripples and the roughness coefficient is larger than for any other regime.

4. Transition roughness regime consists of two types of roughness called a sandbar pattern and a flat bed. The sandbar roughness consists of long dunes with crests which are not normal to the flow. The flat bed is free of sandwaves and has a roughness coefficient which is smaller than that for a plane bed.

5. Anti-dune regime is characterized by a wave train on the water surface and by dunes which travel upstream. The roughness coefficient is about the same as for a flat bed. The sediment transport increases in order for each of these regimes with the anti-dune regime carrying the maximum sediment load.

Microfilm $2.20; Xerox $7.80. 168 pages.

EDDY DIFFUSION IN OPEN CHANNEL FLOW

(L. C. Card No. Mic 59-1449)

Gerald Thorwald Orlob, Ph.D.
Stanford University, 1959

The phenomenon of eddy diffusion in statistically homogeneous turbulent flow has been examined by many investigators and a number of plausible theoretical and empirical relationships have been proposed. The most widely accepted of these is the Einstein equation,

$$D = \frac{1}{2}\,\frac{d(\sigma^2)}{dt},$$

in which D is the coefficient of eddy diffusion, σ is the standard deviation from the mean position of particles scattered in the turbulent regime, and t is time. This equation does not relate eddy diffusion to characteristics of the turbulent field such as eddy size, turbulence intensity, rate of energy dissipation, or Reynolds number. Other relationships such as those proposed by Taylor, Richardson, Kolmogoroff, and von Weizsäcker which do incorporate flow characteristics into the definition of D have not received substantial verification experimentally. The investigation reported in this dissertation examines the most plausible eddy diffusion theories in the light of experimental evidence relating the coefficient of eddy diffusion as defined in the Einstein equation to characteristics of flow in a broad, shallow open channel.

The experimental channel was approximately 38 feet in length, 4 feet wide, and was operated at depths up to 0.30 feet and velocities up to 2.0 feet per second. Meshes of expanded metal covering the channel bottom provided a turbulence which was homogeneous over the channel surface.

Diffusion was confined to two dimensions by using polyethylene particles which floated on the surface of the stream. The shape of the dispersion pattern which resulted from release of these particles at a single point was defined by the general equation,

$$\sigma_z^2 = \frac{2\,\overline{w'^2}}{k^2}\left[\frac{k}{\bar{u}}X - (1 - e^{-(k/u)X})\right],$$

in which σ_z is the standard deviation of the particle dispersion pattern, $\overline{w'^2}$ is the mean square lateral velocity fluctuation, $\bar{u}$ is the mean stream velocity, X is the distance downstream from the source of particles, and k is a constant characterizing the scale of eddies. After experimental verification the above equation was applied to the results of a large number of experimental runs at various channel slopes and velocities. Properties of the flow, such as the coefficient of eddy diffusion, the average eddy size, the turbulence intensity, and the Lagrangian mixing length, were determined.

Experimental plots of the coefficient of lateral eddy diffusion, D_z, versus Lagrangian eddy size, L_e, revealed that the empirical equation of Richardson,

$$D_z = K_1 L_e^{4/3},$$

could be used to approximate the results of a single test series (fixed channel slope and roughness) but that K_1 was probably a function of the energy of the flow.

The similarity principle of Kolmogoroff and von Weizsäcker proposes that

$$D_z = K_2 E^{1/3} L_e^{4/3},$$

where E is the rate of energy dissipation per unit mass, D_z and L_e are as previously noted, and K_2 is a constant. This relation was verified experimentally and K_2 was found to have a value of 0.0136 for all of the slope and roughness conditions examined.

The coefficient of eddy diffusion was also found to be related to Reynolds number, N_R, through the equation

$$\frac{D_z}{\nu} = \left[\frac{w'^2}{\bar{u}}\right]\left[\frac{\ell}{y}\right]N_R$$

where $\sqrt{\overline{w'^2}}/\bar{u}$ is the lateral turbulence intensity, ℓ/y is the ratio of Lagrangian mixing length to channel depth, and ν the kinematic molecular viscosity. The product of turbulence intensity and ℓ/y was found to be virtually constant for the rough channels investigated.

Microfilm $2.10; Xerox $7.40. 160 pages.

ENGINEERING, MECHANICAL

A STUDY OF TURBINE PERFORMANCE IN A NONSTEADY FLOW FIELD

(L. C. Card No. Mic 59-783)

Douglas Frank White, Ph.D.
The Pennsylvania State University, 1958

The problem undertaken is a performance study of a single stage axial-flow turbine which is supplied with energy in the form of finite-amplitude gas pressure waves. Turbines operating under such conditions are called "pulse" turbines or "blowdown" turbines, and are widely used for turbocharging reciprocating internal combustion engines.

The investigation is divided into three parts. The first part consists of an experimental study of the interaction of finite-amplitude waves with various geometric configurations intended to simulate turbine passages. The results of

these tests indicate that the flow induced by a wave in a two-dimensional passage behaves in a one-dimensional manner, the flow properties remaining essentially uniform across the section.

The second part of the study is devoted to the development of a theoretical analysis of nonsteady flows induced by a finite-amplitude wave within the nozzles and blades of an axial-flow turbine. The analysis is based on the method of characteristics for quasi-one-dimensional nonsteady flow. A solution was obtained by means of the usual semi-graphical procedures, but the time required for a single solution was prohibitive. Accordingly, the problem was programmed for the IBM 704 Electronic Data Processing Machine. Machine calculation time for a given set of initial data is of the order of one minute, compared with a "hand" calculation time of the order of 100 hours. The computor program can be used for a wide range of initial data.

The final part of the investigation consists of a series of tests to measure directly the performance of a single stage axial-flow turbine operating under actual nonsteady flow conditions. A comparison of the data obtained with corresponding analytical results shows excellent agreement between theory and experiment.

It is concluded that the theoretical analysis is valid, and can be used to predict performance data of blowdown turbines for a wide variety of operating conditions. In addition, a comparatively simple and reliable experimental method has been developed for the direct measurement of the performance of existing blowdown turbines under nonsteady flow conditions.

Microfilm $2.15; Xerox $7.60. 161 pages.

ENGINEERING MECHANICS

ON ELASTIC IMPACTS OF SPHERES AND SHORT RODS ON LONG RODS, AND ON THE USE OF ACCELEROMETERS IN DETERMINING DYNAMIC CHARACTERISTICS OF MATERIALS

(L. C. Card No. Mic 59-1353)

Cliff S. Barton, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Roland H. Trathen

The work of this study is divided into two sections. First, a study of some impacts of milli-seconds duration, and second, an investigation of some impacts of micro-second duration.

Section I discusses the development of a method for studying dynamic properties of plastics and rubber-like materials under impact loadings of milli-second duration. The cylindrical specimens to be tested are placed on the plane end of a short steel bar hung as a ballistic pendulum. Another bar, also hung as a ballistic pendulum, is made to impinge upon the specimen. The force acting on the specimen during the time of impact is measured by an accelerometer fixed to the impacted bar. From the acceleration-time diagram, which is recorded on an oscilloscope, the force acting on the specimen during impact is determined by integrating twice the acceleration-time diagram. The accelerometer method represents a considerable improvement as compared with the optical method (drum camera method) which is briefly described herein. Experiments conducted using the accelerometer method for different conditions of temperatures and impact loadings are described and the results compared with those obtained by the drum camera method.

Section II contains an investigation of the validity of the principle of impacts set forth by Hertz as applied to the longitudinal impact of a bar. The impacts, of micro-second duration, are created by spheres and short bars striking the plane end of an infinitely long cylindrical bar. An experimental verification and a theoretical analysis for the elastic impact of steel balls on a long steel bar is presented. Five balls of diameters ranging from 1 to 2 inches are dropped from heights ranging from 7.5 to 30 centimeters to impact longitudinally a one inch diameter bar which is instrumented with electric gages for sensing the pulse. Experimental results compare in table and graph form the pulse length, pulse amplitude, pulse shape, and time of peak amplitude as computed from the theoretical analysis. The electronic circuitry and equipment developed are described.

The impacts of short cylindrical steel bars of various lengths against a very long bar are also described. The bars are of one inch diameter with hardened ends to assure elastic impact. Round ends are impacted against plane ends to study the effects of the round ends on the pulse. Impact velocities are varied according to heights of drop which range from 2.5 to 10 centimeters. The short impact bars are suspended as ballistic pendulums, and their lengths vary from 1 inch to 100 centimeters. The long bar is supported on friction free bearings, and both long and short bars are instrumented with electric strain gages to sense the induced strain pulse. The impact theory of Hertz as modified by Sears and Volterra is compared with the experimental results in table and graph form. The electronic circuitry and equipment are also described.

Microfilm $2.35; Xerox $8.20. 180 pages.

UNIAXIAL AND FLEXURAL BEHAVIOR OF RAPIDLY LOADED STEEL AND ALUMINUM BARS

(L. C. Card No. Mic 59-488)

Robert Alexander Collins, Ph.D.
University of Illinois, 1958

The purpose of this experimental investigation was to study the time sensitive engineering behavior of several structural metals subjected to rapidly applied loads. The metals tested were a semi-killed steel, a fully killed steel, a low alloy steel meeting ASTM A-242 specification, USS T-1 steel, and 6061-T6 aluminum alloy. Companion specimens of all five materials were tested uniaxially in tension and compression. The semi-killed and fully killed steels and the aluminum alloy were also tested rapidly in flexure. The flexural specimens had a rectangular cross-section with a depth to width ratio between 2 and 3.

The University of Illinois 20-kip pulse loading machine was used for all the rapid tests. In these tests the rise time to maximum load was 0.006 seconds for the uniaxial specimens and an average of 0.008 seconds for the flexural specimens. After reaching a maximum value, the load remained nearly constant for the remainder of the test.

The materials which exhibited upper and lower yield points in a slow straining test exhibited time-dependent uniaxial behavior in a rapid loading test. This behavior involved the delay time before general yielding and rate of general yielding phenomena. These phenomena are presented with respect to resistance levels in excess of the static yield points. Of the two materials which did not exhibit upper and lower yield points, namely the T-1 steel and the aluminum alloy, only the T-1 steel indicated any time-dependent behavior. This behavior involved the rate of general yielding phenomena similar to that observed for the mild steels. The time-dependent behaviors were the same in tension as in compression for all uniaxial specimens except those of the low alloy steel.

The flexural tests of the semi-killed and fully killed steels also indicated time sensitivity to a rapidly applied load. These specimens developed a resistance which exceeded the static fully plastic resistance by as much as 50 percent in the range of curvature which preceded strain hardening in the beam material. No time dependent phenomena were evident in the rapid flexural tests of the aluminum alloy.

The results of the flexural tests were correlated with those of the uniaxial tests. The correlation procedure involved the use of the measured beam deformations and the time dependent phenomena observed in the uniaxial coupon tests. Flexural resistances computed by this method checked the measured values of resistance within 10 percent. Microfilm $2.00; Xerox $7.00. 147 pages.

INVESTIGATIONS IN THE ELASTIC THEORY OF DISLOCATIONS

(L. C. Card No. Mic 59-757)

John T. Frasier, Ph.D.
The Pennsylvania State University, 1958

In recent years, solutions provided by the elastic theory of dislocations have grown in importance due to the opening of areas where they find practical application. By far the most important of these areas is that of crystal dislocations. In many cases, the demands of this physical theory for information related to both general and specific problems have been greater than the elastic theory can supply. For this reason, there is a need for solutions to many pertinent problems. This dissertation provides several such solutions.

The problems solved are: (i) a dislocation on the plane interface of two, joined, dissimilar, semi-infinite, isotropic, elastic solids, (ii) a dislocation in a semi-infinite, isotropic, elastic solid, and (iii) a dislocation in a plate. For the first two, the procedure used in approaching the problems is to determine the solution for a dislocation of arbitrary shape and then apply this general solution to some of the more important problems involving dislocations of specific shape; namely, Volterra type dislocations. The general solutions are obtained by an application of potential theory to the equations of elasticity. For the third problem, the solution for a specific plane dislocation is obtained and considered in detail.

The solution for the arbitrary dislocation on the interface of two dissimilar elastic bodies joined across a plane boundary is presented in terms of the Papkovitch functions for the cases of a dislocation tangential to the interface of the solids and for a dislocation normal to the interface of the solids. The results involve a surface integral over the plane area of the dislocation. The integrand includes the function describing the shape of the dislocation. As special cases of the general solution the simple Volterra dislocations of the first three orders are analyzed and discussed.

The solution to the problem of a dislocation in a semi-infinite solid is presented in terms of the Papkovitch functions. As in the preceeding problem, these functions involve a surface integral over the plane area of the dislocation. Also, as previously, this integral contains the function describing the magnitude of the dislocation. Specific problems solved are for Volterra dislocations over areas parallel and normal to the free boundary of the solid.

The final solution presented is for a dislocation consisting of a specified discontinuity in the displacement normal to a straight line in an infinite plate. The stress state associated with this dislocation is examined in detail. In conjunction with this solution the results of two photoelastic tests involving dislocations are presented and discussed.
Microfilm $2.40; Xerox $8.40. 184 pages.

DISCONTINUITY THERMAL STRESSES IN SHALLOW SPHERICAL SHELLS

(L. C. Card No. Mic 59-1195)

Owen Hopkins Griffith, Ph.D.
Cornell University, 1958

An analytical investigation is made of thermal stresses in a shell composed of a spherical section with a circular cylindrical section attached, axes of both sections being coincident. The wall thicknesses of both sections are constant although not necessarily equal. The temperature distribution is axisymmetric and varies only through the thickness. The modulus of elasticity and the coefficient of linear expansion are known functions of temperature, while Poisson's ratio is assumed constant. Internal pressure may exist, also, and its superposition on the thermal problem is considered.

Thin shell approximations, with second order effects neglected, are used in deriving the equations. The theory of shallow spherical shells as introduced by Reissner is used. Outer boundaries of the spherical and cylindrical sections are sufficiently removed to have no effect on the mutual boundary of the two shell sections. Conditions at the mutual boundary are considered, taking into account the continuity of vertical forces, horizontal forces, edge moments, and edge rotation. Solutions in closed form are obtained for each section.

For the case where the material properties are not functions of temperature but are constants, and where the temperature gradient is linear, the solutions are given in

nondimensional closed form. Shell dimensions are also given as nondimensional ratios, with typical ranges indicated. For a particular shell configuration, nondimensional results are tabulated, curves are drawn, and solutions are discussed. A sample problem is worked, after which a comparison of stresses in the shell is made showing the significant increase of the stresses at the mutual boundary.

Microfilm $2.00; Xerox $4.00. 75 pages.

SCABBING AND PULSE PROPAGATION IN MATERIALS

(L. C. Card No. Mic 59-764)

Sudhir Kumar, Ph.D.
The Pennsylvania State University, 1958

The objective of the present work was to study theoretically the propagation of stress in uniaxial systems and the resulting permanent deformation and scabbing that may occur when a certain stress strain behavior of the material is given and a certain pressure pulse is prescribed. First, a physical discussion of the phenomenon, factors affecting its occurrence and some other possible kinds of damage that can occur, are presented. A critical review of the past experimental and theoretical work and suggestions for further possible experiments on scabbing are then given. This review is followed by an elastic analysis of pulse propagation and scab formation in bars and plates based on the linearity of the stress-strain relation under high rates of loading. Thereafter, some applied aspects of the elastic analysis are presented. It should be noted that in general the elastic analysis is limited to loads lasting a few micro-seconds. This is because loads of longer duration of the order of one-tenth of a second give rise to plastic flow. To take this into account an elastic-plastic analysis called "The Stress-Jump Method" is developed and applied to problems of stress propagation and scabbing in bars. This method however, has the limitation that a given non-rectangular pulse shape has to be approximated by a number of rectangles. This procedure becomes quite cumbersome if accuracy is desired. In order to overcome this difficulty, a new method designated as "The Strain Contour Method" is developed. In this method contours of strain and particle velocity are considered instead of stress and velocity jumps and thus the actual shape of the pulse can be taken into account without breaking it into rectangles. Rules for plotting these contours have been derived and stated. Examples of typical contour plots have also been worked out. The foregoing analysis completes a definite theoretical method of attack on the problem of propagation of stress in uniaxial systems.

Microfilm $2.00; Xerox $6.00. 121 pages.

DYNAMIC RESPONSE OF AN ELASTIC-PLASTIC BEAM TO IMPULSIVE LOADING (A MOVING BOUNDARY PROBLEM)

(L. C. Card No. Mic 59-1450)

David Albert Rodriguez, Ph.D.
Stanford University, 1959

A study is made of the motion of a simply supported elastic-plastic beam with an initial sinusoidal velocity distribution. The structural material is considered to be ductile and the beam cross section is an I or a wide flange shape, so that the moment-curvature relation may be approximated by the well known moment-curvature diagram of the perfectly plastic, ideal I-beam. That is, in the region of elastic strains the moment is equal to the curvature multiplied by the elastic flexural rigidity of the beam. When the moment becomes equal to the dynamic yield moment, M_p, plastic flow starts and the moment remains constant at M_p so long as plastic flow continues. The Euler fourth order partial differential equation,

$$EIy^{IV} + m\ddot{y} = 0 ,$$

is taken as the mathematical model for the dynamic behavior of the beam under elastic conditions.

Seiler, Cotter, and Symonds[1] obtained a solution to the problem by assuming that, when the maximum moment, which is the moment at mid-span, first reaches the value M_p, a discrete plastic hinge forms and remains at the center of the beam. However, numerical calculations showed that the solution based on this assumption violated the moment plasticity condition in that portion of the span which had been assumed to be elastic.

In the present work, the motion of the beam is first studied under this same assumption that the plastic hinge remains discrete or isolated at the center of the beam. A solution is developed in a form suitable to represent conveniently the motion of the beam in the region adjacent to the plastic hinge for a short period of time after the formation of the hinge. It is demonstrated that the plasticity condition is violated at a section of the beam arbitrarily close to the first plastic hinge at a time arbitrarily close to the time at which this hinge appeared. From this it is concluded that the hinge does not in fact remain discrete but tends instead to spread into a plastic zone or region.

The behavior of the beam is thus seen to constitute a moving boundary problem. In the region between the supports and the elastic-plastic interface, the elastic differential equation governs the motion of the beam. In the plastic region, the plasticity condition requires that the moment have the constant value, M_p. This means that there can be no inertia loads in this portion of the span; i.e., the acceleration must be zero. This constancy of moment also implies that the shear in the plastic zone is zero. Hence, at the elastic-plastic interface, the shear is zero and the moment is M_p. However, an additional condition is needed to specify the position of the interface as a function of time. An investigation of the mechanical implications of the behavior of successive derivatives of the deflection curve in the vicinity of the moving boundary yielded the needed additional condition, which can be expressed mathematically in the form of the following relationships:

$$\ddot{y}(z(t),t) = 0 \quad \text{and} \quad \lim_{\substack{x \to z \\ x < z}} [\ddot{y}(x,t)] < 0 ,$$

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

where y is the deflection, x is distance along the beam, and z(t) is the position of the elastic-plastic interface.

The study ends with the development of a method for the complete solution of the problem using finite difference techniques. Moreover, the appearance of singular behavior necessitated the construction of an analytic solution affording an approximate representation of the motion for a short period of time after the start of plastic flow.

Microfilm $2.00; Xerox $5.80. 120 pages.

1. J. A. Seiler, B. A. Cotter, and P. S. Symonds, "Impulsive Loading of Elastic-Plastic Beams," Journal of Applied Mechanics, vol. 23, 1956, pp. 515-521.

PLATE INVESTIGATIONS BY AID OF THE EXTENDED FROZEN STRESS METHOD

(L. C. Card No. Mic 59-771)

Joseph Schwaighofer, Ph.D.
The Pennsylvania State University, 1958

Statement of the Problem. Experimental methods are employed to determine the state of stress in laterally loaded plates if boundary and loading conditions render the problem inaccessable to theoretical solutions. Most experimental methods make use of models. In transferring the experimentally obtained stress distribution from the model to the prototype a difficulty arises in certain instances due to the fact that the material of the model and the prototype have different Poisson's ratio. The objective of this thesis was to develop an experimental technique which makes possible the evaluation and correction of the influence of Poisson's ratio on the stress distribution.

Approach to the Problem. The only experimental method available at the present time which permits exploration of the state of stress at the surface and in the interior of an elastic body when subjected to load is three-dimensional photoelasticity. The conventional Frozen-Stress method provides an excellent means to describe the state of stress at any point in the model. However, such an investigation - when using presently available plastics - gives the stress distribution for the case where Poisson's ratio is about 0.5, but furnishes no indication of what changes in the stress distribution take place if Poisson's ratio for the model has other values. In order to evaluate this change in the stress distribution a new type of three-dimensional photoelastic test was proposed and carried out. It utilizes a Poisson's ratio of 0.37 and a Freezing Temperature of 140^0 F. Knowing the magnitude of the stress at each point for Poisson's ratios of 0.5 and 0.37 inter- or extrapolation gives rather accurate results for the stress distribution for any Poisson's ratio.

Results. The attempt to evaluate experimentally the change in stress distribution in laterally loaded plates due to a change in Poisson's ratio was successfully accomplished by combining the test results of the conventional Frozen-Stress method with the new "Frozen Stress method with small deformations". The stress distribution in a circular plate subjected to uniformly distributed load within a small concentric circle with respect to the center of the plate was investigated by the two methods and compared with the theoretical solution. Close agreement was found in both cases and inter- or extrapolation showed sufficient accuracy.

Conclusions. The experimental method employed for the purpose of evaluation of the influence of Poisson's ratio on the stress distribution in laterally loaded plates resulted in the extension of the Frozen Stress concept. It successfully supplements the conventional Frozen Stress method in cases of thin-walled models or in those cases in which the large deflections of the conventional Frozen Stress method are objectionable. It was shown in this dissertation that three-dimensional photoelastic tests can be conducted not only at the critical temperature but as well at low and medium temperatures, depending upon the nature of the problem, the information desired and the photoelastic material used. By combining the conventional Frozen-Stress method and the "Frozen-Stress method with small Deformations" the influence of Poisson's ratio on the stress distribution can be determined. This procedure is of course applicable not only to laterally loaded plates but to any three-dimensional or two-dimensional problem.

Microfilm $2.00; Xerox $6.40. 133 pages.

A MOVING MASS ON A STRING

(L. C. Card No. Mic 59-575)

Robert Wesley Shreeves, Ph.D.
University of Illinois, 1958

There are two main problems which are treated in this paper. The first problem deals with a semi-infinite string and the second problem deals with a finite string. It is desired to find the deflection of the string at any time due to the action of a mass moving across the string; acting vertically on this mass is any arbitrary forcing function. The string in question, in both cases, is assumed to be weightless but not massless. The tension in the string is assumed to be constant, and, therefore, arbitrarily assigned. The deflections of the string are assumed to be small and the equations describing the motion are linear. In fact, the equation of motion for the string, except under the load, is the homogeneous, hyperbolic, wave equation. For convenience, the mass is assumed to be travelling at constant velocity and the initial deflection and velocity distributions are assumed to be zero.

Expressions for the deflection of the string on either side of the load are obtained by the Riemann-Volterra method of characteristics. These expressions are related by obtaining a differential equation of motion under the load. For the semi-infinite string problem, this differential equation is solved by the method of Frobinius and the deflection of the string anywhere may be obtained for any velocity and any time. For the finite string problem, this differential equation turns out to be a functional, difference equation and is solved by a step-wise integration process which is carried out by the University's automatic digital computor.

The particular problem that is solved in both cases is one in which it is assumed that the only vertical force acting on the mass is its own weight. Also, the velocity of the

moving mass is restricted in that it must always be one third, or greater, of the velocity of wave propagation of the string.

Finally, curves are drawn for the semi-infinite and finite strings for different values of time and different velocities, tensions, and lengths. These curves show that the semi-infinite string equations are valid for the finite string problem for all time between zero and the time it takes the propagated wave to reach the end of the string. Also, a comparison is made for a finite massless string and a finite string with mass. If one is interested in the maximum deflection of the string, he may make a conservative estimate of this deflection by neglecting the string's mass.

Microfilm $2.00; Xerox $4.00. 73 pages.

THERMOELASTIC STRESS IN PLATES —— PROBLEMS IN CURVILINEAR COORDINATES

(L. C. Card No. Mic 59-1459)

Charles Edward Wallace, Ph.D.
Stanford University, 1959

Thermoelastic problems of three types are treated by finding a particular solution which reduces the problem to one of boundary loading.

The first involves an arbitrary two-dimensional temperature distribution. The temperature, given in curvilinear coordinates (including polar), is expanded as a Fourier series, and a series solution is obtained for a displacement potential. Special problems treated are the circular disk and ring with an arbitrary temperature distribution and the uniformly hot elliptic spot in an infinite plate. A particular solution is given for the elliptic tube with a steady state temperature distribution.

The second problem is the plate with arbitrary face temperatures, the internal temperature being linear through the thickness. The basic equation is similar to that of the first problem and the corresponding solutions are applicable.

A thin plate, its temperature being dependent on the x-coordinate only, represents the third problem. A simple particular solution is given and the associated boundary value problem may be solved in closed form using methods from Muskhelishvili's "Some Basic Problems of the Theory of Elasticity." Complete closed form solutions are obtained for the circular disk with a hot segment and for an infinite plate with an elliptic hole and a discontinuous temperature. The tangential stress at the ends of one axis (a) of the elliptic hole is $\pm E\alpha T\left(\frac{4a}{\pi b} + 1\right)$, when the temperature is uniformly T on one side of the other axis produced, and -T on the other side. As $\frac{b}{a}$ tends to zero (the ellipse becomes a crack lying across the temperature discontinuity), this stress increases without bound.

Microfilm $2.00; Xerox $4.80. 92 pages.

ENGINEERING, METALLURGY

MECHANISMS OF CORROSION OF 310 STAINLESS STEEL BY VANADIUM OIL ASHES

(L. C. Card No. Mic 59-395)

Martin Henry Leipold, Jr., Ph.D.
The Ohio State University, 1958

The mechanism of corrosion of 310 stainless steel by an ash of low grade fuel oil, specifically $Na_2O{\cdot}V_2O_4{\cdot}5V_2O_5$, is investigated by means of thermogravimetric analysis and x-ray diffraction analysis. Results indicate an initial period of corrosion in which diffusion of ions through the oxide is controlling. During this period, iron is preferentially removed from the stainless steel resulting in a second, composition controlled period. Finally, an equilibrium composition gradient obtains and a final diffusion mechanism becomes controlling.

In contrast to these changeable results for stainless steel, the results for the pure constituents, iron, nickel, and chromium, indicate that a single mechanism, controlled by diffusion, exists. The diffusion rate constants with the corrodent are the same as those for the oxidation of each of the pure metals without corrodent.

With the stainless steel, a change in the corrosion product occurs at 1450° F, accompanied by a substantial change in the corrosion rates. The change in rate is credited to the presence of a different diffusion media.

Microfilm $2.00; Xerox $4.60. 86 pages.

ENGINEERING, SANITARY AND MUNICIPAL

STABILIZATION PONDS FOR THE REMOVAL OF ALGAL NUTRIENTS FROM SEWAGE AND SEWAGE EFFLUENTS

(L. C. Card No. Mic 59-1394)

Harry Masato Kaneshige, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Gerard A. Rohlich

The Problem

In order to evaluate the performance of stabilization ponds under local conditions, an experimental pond constructed near the Madison, Wisconsin Nine Springs Sewage Treatment Plant was studied from September, 1955 to December, 1957. The effectiveness of the pond in removing algal nutrients, particularly nitrogen and phosphorus, from primary and secondary effluents was investigated.

Methods

The pond consisted of three cells in series with a total surface area of 0.45 acre at 3.5 ft depth. The pond was operated at detention times of two to ten days with and without recirculation. To provide artificial mixing an aeration system was installed. Two depths, 2.1 ft and 3.5 ft,

were used. Samples from the outlet end of each cell and from the pond influent were analyzed once or twice a week.

Chemical analyses were made for ammonia, nitrite, nitrate, and organic nitrogen, soluble phosphate phosphorus, dissolved oxygen, biochemical oxygen demand (B.O.D.), pH, and alkalinity.

Biological observations included suspended solids and total solids determinations and identification of the pond algae.

Results

Data in the form of graphs are presented for physical measurements such as temperature, solar radiation, rate of flow, and detention time, and chemical measurements such as B.O.D., nitrogen, phosphorus, and pH.

Tables include a summary of all the chemical and biological analyses made routinely, a summary of a test of the effectiveness of mixing by artificial aeration, a comparison of suspended solids and B.O.D. reductions during periods of low algal activity, and results of dissolved oxygen surveys.

The more important findings of this investigation were as follows:

1. The progressive decrease in water loss from about 71,000 gallons per acre per day (gpad) to 34,000 gpad indicated that the bottom of the pond was undergoing partial sealing.

2. The air compressor-plastic pipe aeration system was effective in mixing the pond contents vertically. This mixing improved nitrogen removal, but had little effect on B.O.D. removal.

3. Detention time between two and ten days had no effect on B.O.D. removal, whereas nitrogen removal during the summer increased as detention time increased, with maximum removal at about ten days. Based on filtered pond effluent samples, the B.O.D. of the pond influent was reduced about 60 per cent in the pond. The average nitrogen removal throughout the year was about 30 per cent, with removals in the summer reaching about 70 per cent.

4. Phosphorus removal during periods of high algal activity occurred through precipitation by the high pH resulting from algal activity.

5. Impoundment of final effluent without artificial aeration caused the dissolved oxygen content to decrease considerably below the levels in the influent, but with the growth of algae in the impounded water the dissolved oxygen concentration increased to levels considerably higher than that in the influent.

Microfilm $2.55; Xerox $8.80. 195 pages.

FINE ARTS

THE ILLUSTRATIONS OF THE LITURGICAL HOMILIES OF GREGORY OF NAZIANZUS

(L. C. Card No. Mic 58-7843)

George P. Galavaris, Ph.D.
Princeton University, 1958

This study deals with the illustrations of the liturgical homilies of Gregory of Nazianzus. The term "liturgical" applies to sixteen homilies selected from the full edition of the forty five. This shortened edition has a liturgical character. Each homily is read on a certain feast day and the arrangement of the homilies follows the arrangement of the most important of the liturgical books, the lectionary.

These sixteen homilies written during the second half of the fourth century represent two streams of thought, the religious and the secular, the latter being in the service of the former. The main problems are: (1) to see whether these two streams of thought are also represented in the illustrations of the homilies, the earliest extant illustrated manuscripts of which is not older than the first half of the eleventh century, (2) to bring forth the liturgical character of the book and its influence on the illustrations.

The several extant illustrated manuscripts of the homilies can be classified into two groups: those which have title miniatures and those which in addition to the title miniatures have supplementary illustrations. This classification has been taken into consideration in our methodological procedure. We first deal with the title miniatures and then with the supplementary miniatures. A further distinction is made in each of the two parts between "invented" and "migrated" miniatures. This distinction is based on the relation of pictures to text. The term "invented" applies to the miniatures which can be explained by the text of the homilies whereas the term "migrated" applies to the miniatures which have been borrowed from other tests. This distinction involving the grouping of the miniatures according to their iconography, is necessary in order to define the exact relation of the manuscripts to each other. These problems are dealt with in chapters III and IV. Chapter I is devoted to the known facts of the author's life, the content of the homilies and the text; and chapter II considers briefly the fully illustrated manuscripts of the liturgical edition.

The results indicate that all manuscripts belong to the same recension; all stem from an archetype which was probably illustrated sometime in the tenth century. Shortly thereafter the supplementary illustrations were added to this archetype. These problems are dealt with in chapter V.

Chapter VI is devoted to the epilogue, but questions of style and dating have for the most part been reserved for chapter VII which contains a catalogue of all manuscripts of the liturgical edition.

The general conclusions are: the liturgical homilies (1) emphasize the liturgical aspect of Middle Byzantine art and the influence of the lectionary on their illustrations, (2) contribute greatly to the classicism and renaissance movement of the Macedonian period, (3) contribute greatly to our knowledge of the monastic influence upon Middle Byzantine art, (4) shed more light on the problem of traditionalism on the one hand and the artist's inventiveness on the other. Microfilm $5.70; Xerox $20.00. 448 pages.

WATER AND ARCHITECTURE

(L. C. Card No. Mic 58-7870)

Charles Willard Moore, Ph.D.
Princeton University, 1957

This study investigates the capabilities and limitations of water as an element in architectural composition. It investigates the medium itself, and the effect it has had on man's mind, on his society, and on his works. It examines the form water takes, in combination with land forms, with plants, and with sculpture, and then with light, sound, and fire, to create spectacle. It studies the content with which man invests these forms in his architectural compositions, noting that water has symbolized fertility and purity, life and death, time and the timeless, and immediacy and distance, and taking the forms of water, flowing and falling, shooting, still, and suggested to develop the idea that these forms of water have been expressive of the relation of man to the natural world, whether he was seeking harmony with it, separate from it, or asserting mastery over it.

Since our own relation to the natural world does not find its expression either in the historic western imposition of a geometric order on nature or in the oriental quest for "naturalness," our use of water in architectural composition will be related to the more complex geometries of our own day, which operate in time as well as in space. It should make use of the mythic as well as the real continuity of water to develop a suggestion of distant, almost infinite space, even while it is developing an immediacy, a sense of contact with the spectator. Our use of water, too, will require architectural composition in time, both in measurable chronological sequence and in the establishment of a relation to natural rhythms, and the sense of time beyond man's measure.

To test these principles of design with water, this thesis develops designs for two sites: Park Avenue in New York, and a section of Marble Canyon and Glen Canyon, Arizona. On Park Avenue, designs for fountains at Lever House, the Seagram Building, and St. Bartholomew's Church are meant to enhance the buildings with which they are related, and to help reestablish the unity of that street which the establishment of new kinds of urban open space threatens temporarily to destroy. In Arizona, designs for a town and a restaurant concentrate on full use of water in the desert for its cooling and refreshing qualities. A twenty-minute drive from Highway 89 to an early proposed site for the Glen Canyon Dam is designed as a composition in time at the scale of the automobile, depending on the gradual introduction of the forms of water to achieve development to a climax at the dam.

Microfilm $4.80; Xerox $16.00. 373 pages.

THE EFFECT OF BORATES AND OTHER INHIBITORS ON ENZYMATIC BROWNING IN APPLE TISSUE

(L. C. Card No. Mic 59-473)

Karakian Bedrosian, Ph.D.
University of Illinois, 1958

The effect of borates and other inhibitors on enzymatic browning in apple tissue was investigated. In addition to sodium tetraborate, the effect of sulfite, sugar, salt, citric acid, disodium phosphate and ascorbic acid alone and in various combinations was investigated. Apple slices were prepared from Stayman Winesaps held in storage at 34°F. The slices were impregnated with the various treatment solutions, packaged and stored at 45° for 48 hours. The slices were then evaluated by a panel of eight members for color. Color photographs were also taken of the different samples.

Sodium tetraborate was an effective means of controlling browning in apple slices. The concentration of STB necessary was approximately 1.5%, but this will vary with differences in maturity and variety. The activity of STB as a browning inhibitor did not vary with pH. It was observed that the presence of salt, sucrose, ascorbic acid, disodium phosphate and sodium bisulfite did complement the action of STB. The combination of 0.50% STB and 50 ppm SO_2 completely inhibited enzymatic browning in apple slices.

The activity of ascorbic acid as a browning inhibitor for apple slices was found to vary with pH, being optimum around pH 5-7. A treatment solution containing 0.25% ascorbic acid and 0.50% STB was an effective means of controlling browning at these pH's. It was found NaCl (0.50%) and disodium phosphate (2.0%) also interacted favorably with ascorbic acid against enzymatic browning.

Both sucrose and dextrose were found to be equally effective as inhibitors when used with STB. A treatment solution containing 0.10% STB and 15% sucrose gave effective control of browning. With solutions containing 0.50% STB, only 10% sucrose was necessary. It was observed that ascorbic acid and sulfite also interacted favorably with sucrose as browning inhibitors.

The activity of sodium bisulfite as an inhibitor of enzymatic browning in apple slices was found to vary with pH; the optimum pH was in the acid range. In addition to STB, NaCl and sucrose also exhibited favorable interactions with SO_2. NaCl and disodium phosphate exhibited inhibition activity. The concentration necessary was in the range of 1-2%. The activity of both of these compounds was improved by the presence of STB and ascorbic acid.

Citric acid did not exhibit any activity as a browning inhibitor.

The effect of STB on acceptability of apple slices was also investigated. Slices were treated with solutions of ascorbic acid (0.50%), sulfite (100 ppm), ascorbic acid (0.50%) plus STB (0.50%) and sulfite (100 ppm) plus STB (0.50%). The slices were evaluated by a panel of eight members for flavor, color, texture, and off-flavor. The data was statistically analyzed. There was no detrimental

effect of STB on flavor, off-flavor, or texture. The addition of STB to ascorbic acid and sulfite resulted in better control of enzymatic browning initially and throughout the 14 days of the storage period.

With pure systems of enzyme, catechol and polypherolic extract from apples, it was shown that the STB inhibited enzymatic browning by complexing the otho di-OH group of the polypherol. Microfilm $2.00; Xerox $5.20. 101 pages.

EFFECTS OF IODIZED SALT AND OTHER IODINE COMPOUNDS ON THE QUALITY OF PROCESSED VEGETABLES

(L. C. Card No. Mic 59-373)

Fathalla Abd El-Salam El-Wakeil, Ph.D.
The Ohio State University, 1958

The use of iodized and iodated salts in the processing of fruits and vegetables as an antigoiterous measure has been advised. This study was carried out to investigate the effect of the use of iodized salt and some other iodine compounds on the quality and nutritive value of whole kernel sweet corn, tomato juice and sauerkraut. The chosen iodine compounds were KI (and pure and commercial sodium thiosulfate for its stabilization), an iodine-iodide mixture and an iodophore "Iosan." All these chemicals were added in varying concentrations and the evaluations made after 4, 8 and 12 months of storage.

The quality characteristics evaluated were color, which was measured objectively (Hunter Color and Color Difference Meter) and subjectively; flavor and texture, which were evaluated by panel testing; and ascorbic acid and reducing sugars content, which were measured chemically.

The use of iodized salt, KI, iodine-iodide mixture, "Iosan" and the thiosulfate did not affect the color, flavor, or texture of any of the three products. Only one exception, i.e., the adverse effect of 100 p.p.m. of iodine-iodide mixture on the flavor of tomato juice, was found. The same chemicals at the same concentrations did not affect the fermentation process in sauerkraut or the final lactic acid content.

However, the use of 50 and 100 p.p.m. of both pure and commercial sodium thiosulfate induced the discoloration and/or corrosion of the cans. When enameled cans rather than plain tin cans were used, as in the case of whole kernel sweet corn, there was no discoloration and/or corrosion. It was concluded that thiosulfate itself induced the discoloration and/or the corrosion of the containers, not the impurities in the commercial formulations as had been suspected.

All the chemicals applied and the iodized salt did not affect the nutritive value, namely, the ascorbic acid content, of the products tested. The ascorbic acid content of the product decreased only as a result of the catalytic oxidative destruction of the vitamin caused by the iron ions liberated in the product (when the thiosulfate induced corrosion in the cans).

No free iodine could be detected in any single treatment, indicating that all types of iodine compounds (especially those containing free I_2) did unite with the organic components of the packed products, thus, affecting their stabilization.

By determining the reducing sugar (dextrose) content of the various vegetables, it was found that all of them, even sauerkraut, contained enough (more than the required 0.05 per cent) inherent-iodine-stabilizer. This suggests the idea of using either KI directly in the packed products in the required concentrations, without the addition of any thiosulfate for stabilization, or any of the other iodine compounds after their medical safety is thoroughly investigated, knowing that the "inherent-stabilizer" would affect such stabilization. This would avoid the discolorative and/or the corrosive effects of the thiosulfate and the accompanying loss of the vitamin content of the product concerned. Microfilm $3.60; Xerox $12.20. 277 pages.

THERMAL OXIDATION OF METHYL ESTERS OF FATTY ACIDS

(L. C. Card No. Mic 59-564)

Venkatachalam Ramanathan, Ph.D.
University of Illinois, 1958

Methyl esters of lauric, stearic and oleic acids were thermally oxidized at 200°C in the presence of oxygen (300 ml/min) for varying intervals of time. The loss in weight of the ester and the amounts of the volatile noncondensible decomposition products in terms of carbon dioxide, carbon monoxide and hydrogen were measured. The release of hydrogen indicated that dehydrogenation is one of the reactions taking place during thermal oxidation. The evolution of carbon monoxide could have occurred by the elimination of a carbonyl group from compounds containing the groups --COCOCOR and --$COCH_2COCO_2R$. Acids of the type HO_2C-CH_2-CO_2CH_3 containing active methylene groups lose carbon dioxide readily when heated.

The volatile decomposition products collected in traps maintained at -80°C by a mixture of dry ice and trichlorethylene contained an aqueous and an oily layer. These layers were taken up in absolute methanol and the different fatty acids and carbonyl compounds identified by paper chromatography. The fatty acids were converted to their corresponding hydroxamates and chromatogramed using water-saturated butanol as the soivent. A variety of fatty acids were identified in the oxidation products of all the esters showing a random oxygen attack. The presence of nonanoic acid in the oxidation products of methyl oleate indicated direct oxygen attack at the double bond. Lower fatty acids were detected in the later stages of thermal oxidation. A variety of aldehydes, identified as their 2,4-dinitrophenylhydrazones, indicated a random oxygen attack of the ester molecule. The presence of nonylaldehyde in the thermal oxidation products of methyl oleate again indicated oxygen attack at the double bond.

The ester phase was analyzed for free fatty acidity, saponification value, Wijs iodine number and precent carbonyl and hydroxyl groups. The total oxygen content calculated from the analysis of these four functional groups compared well with the oxygen content as obtained by carbon hydrogen analysis of the ester phase. From this it was concluded that polymerization occurs either through carbon-carbon linkages or ester linkages. The increase in the acid value as thermal oxidation progressed indicated fission of the ester chain to form free fatty acids and

lower molecular weight esters. The increase in ester value may be due to this fission or to formation of new ester linkages between free hydroxy and carboxyl groups. This increase could also be due to formation of lactones, whose presence has been established by analysis of the infrared spectra.

The presence of hydroxyl and carbonyl compounds indicated the chain of reaction sequence during thermal oxidation. From these considerations, the chemistry of thermal oxidation of methyl oleate in the early stages of the reaction may consist of three fundamental steps--hydroperoxide formation, formation of intermediates containing hydroxyl, carbonyl and carboxyl groups, and association of intermediates to form higher molecular weight compounds. The decomposition of hydroperoxides at 200°C initiates a chain reaction through a free radical mechanism. The volatile products arise from the decomposition of the various hydroperoxides formed during the initial stages of thermal oxidation. With esters of saturated fatty acids, dehydrogenation and thus unsaturation in the molecule occurs first. Further degradation and polymerization of these unsaturated molecules then proceeds in a manner similar to that proposed for methyl oleate.

Microfilm $2.00; Xerox $4.80. 95 pages.

GEOGRAPHY

SUBREGIONAL MIGRATION WITHIN ILLINOIS, 1935-40. AN ANALYSIS OF SELECTED DATA.

(L. C. Card No. Mic 59-475)

Ronald Murray Beveridge, Ph.D.
University of Illinois, 1958

The purpose of this study, Subregional Migration Within Illinois, 1935-40, is to reveal the patterns of gross subregional migration streams within Illinois for the migration interval 1935-40, to analyze these patterns, to find significant correlations of the migration streams with economic and social subregional characteristics, and to discover meaningful generalizations concerning the subregional migration streams. The study is limited to crude migration streams, that is, the migrants are considered without reference to their characteristics such as sex, age, color, etc.

The approach to the study is essentially geographic; considerable use is made of maps as tools of analysis rather than as illustrations. The rank correlation method is used to find significant correlations of the various subregional rates of migration with selected social and economic characteristics of the Illinois subregions. The size and direction of the streams of migrants and the rates of in-, out-, and net migration were compiled and calculated from unpublished Special Census Tabulations of Migrants provided by the Scripps Foundation for Population Studies, Miami University, Oxford, Ohio.

By means of cartographic analysis it is discovered that, for each subregion of Illinois, the largest movements of in- and out-migration occurred reciprocally, in general, with the same contiguous subregion, and the smallest movements of in- and out-migration occurred reciprocally, in general, with the same noncontiguous subregion. This finding is offered as a general hypothesis of subregional migration to be tested in other states.

The greater portion, 54.9 percent of the total intrastate migration occurred within the subregions of the state. The nonmetropolitan subregions, the population of which constituted only 35.8 percent of the total Illinois population, provided 50.4 percent of the total number of migrants. Almost one-third of the total intrastate migration, however, took place within the three metropolitan subregions where such movement was possible. The most striking feature of this intrasubregional metropolitan movement was the fact that four times as many migrants moved from the central cities, Chicago and Peoria, to their own rings as moved in the opposite direction.

There was a strong positive correlation, (1) between the size of the total out-migrant and in-migrant streams, and (2) between the total resident subregional population and the number of migrants originating in each subregion.

The trend of net migration was from south to north. Intersubregional movement in Illinois, 1935-40, accounted for a significant portion, either negatively or positively, of the subregional population increase in the 1930-40 census period.

A study of the rates of migration reveals that metropolitan subregions had relatively little attraction for migrants from other metropolitan subregions, while the populations of the metropolitan subregions were being infiltrated chiefly by migrants from nonmetropolitan subregions. Of all types of communities in the metropolitan subregions the rural-nonfarm communities had the greatest success in recruiting new population; however, the attractive power of urban communities for out-migrants from other subregions was greater than that of the rural communities.

The nonmetropolitan subregions were exchanging migrants with other subregions three times as fast as the metropolitan subregions. There was a degree of decentralization of the population noted in the nonmetropolitan subregions analogous to that in Chicago and Peoria.

The highest rates of net gain were recorded by the metropolitan subregions at the expense of the nonmetropolitan subregions, and the greatest rates of net loss were suffered by the southern nonmetropolitan subregions.

The rates of net migration tended to vary directly or inversely with many of the economic and social subregional characteristics. The most significant correlations were, (1) the inverse correlation with the rate of unemployment, (2) the direct correlation with the proportion employed in manufacturing industries, and (3) the direct correlation with educational attainment of the subregional population.

Microfilm $2.00; Xerox $6.40. 131 pages.

A GEOGRAPHIC ANALYSIS OF THE CHAUTAUQUA-ERIE GRAPE INDUSTRY

(L. C. Card No. Mic 59-1385)

Richard Ernest Dahlberg, Ph.D.
The University of Wisconsin, 1959

Major Professor: Clarence W. Olmstead

A study in agricultural geography, this dissertation is developed around the following two-fold objective: (1) analysis of the geography of the Chautauqua-Erie grape industry, and (2) investigation of the extent to which the analysis of farm units contributes to such a study.

The analysis was confined almost completely to the Chautauqua-Erie area; only brief consideration was given to the national grape industry. Hemmed in between Lake Erie and the Allegheny Escarpment, the study area stretches along the narrow lake plain of Chautauqua County, New York and Erie County, Pennsylvania for more than 50 miles. Grapes of the Concord variety comprise over 95 per cent of the estimated 25,000 to 27,000 acres of vineyard in the area. Nearly all these grapes are converted to unfermented juice. The total pack from the area represents over half of the national pack of grape juice. Today, after a century of commercial development, the marketing structure is dominated by grower cooperatives, with an efficient advertising and sales program which has placed Chautauqua-Erie grape products in retail outlets in nearly all parts of the United States.

Study of over 500 farms producing grapes revealed the ways in which grape production is associated with the tree fruit, small fruit, truck crop, dairy, and poultry enterprises in this area. Although the land occupancy strength of grapevines varies, the grape enterprise is relatively important in all townships of the Chautauqua-Erie area. Other enterprises manifest greater spatial variations in land occupancy strength; none exhibit a pattern similar to that of the grape enterprise.

The area of intensive grape production is markedly linear in form, roughly centering upon a zone of beach ridges where grapevines occupy 20 to 30 per cent or more of the land. Clusters of grape-processing factories correspond closely to major vineyard concentrations. The area of the grape processing industry may be described as a nodal region in which, during certain years, grapes are received by the Chautauqua-Erie core from areas nearly 400 miles away.

This analysis of the Chautauqua-Erie grape industry, and especially its internal spatial structure, contributes to a comparative geography of highly specialized fruit areas. The study demonstrates the complementarity of data on functioning spatial units (farms) and data on statistical reporting units such as counties and townships used by the Census. It not only makes apparent the differences between the two kinds of data but it also shows how they may be used to mutual benefit.

Microfilm $4.50; Xerox $15.20. 352 pages.

THE RISE AND DEVELOPMENT OF THE FRUIT INDUSTRY ON THE OKAYAMA PLAIN

(L. C. Card No. Mic 58-3682)

Hiroaki George Kakiuchi, Ph.D.
University of Michigan, 1958

This study is an attempt to discover, describe, and analyze the principal factors which enabled the fruit industry to rise and develop on the Okayama Plain. The importance of fruit is that it constitutes an important source of income for many hard-pressed farmers who must devote most of their acreage to subsistence crops.

The study begins with a brief description of the physical environment of the Okayama Plain to see how it favored the development of the fruit industry. A historical sketch follows describing how the industry developed. Then examples of how the fruit crops became established in competition with other crops and side lines are examined. Examples of farm management are presented to see how the farmers have distributed their various crops on their small farms. Finally, because fruit is a commercial crop, the marketing procedure and markets are examined.

The physical environment of the Okayama Plain is one of the best in Japan for fruit-growing. The trees prosper on the many well-drained slopes in parts of the plain. The relatively dry and sunny summers produce excellent fruit.

The fruit industry on the Okayama Plain began after the Meiji Restoration in 1867. The rise of new industries, urbanization, and the consequent growth of population brought increased demand for fruit. The development of railroads offered safe and rapid transport for the perishable fruit. These factors caused the fruit industry to expand rapidly until World War II. During the war the industry stagnated due to government pressure to grow staple food crops, but after the war the fruit industry continued its expansion once again.

Fruit is a cash crop, and competes with other crops for space and with side lines for labor. During the Meiji Period (1867-1911) fruit crops became important as prices for indigo, cotton, and sugar declined due to cheaper imports. Fruit, except for grapes, cannot tolerate a high water table, and usually does not compete with paddy crops. Side lines such as the making of straw plait and vermicelli were poor sources of income, and fruit often replaced them.

Fruit is an important part of the farm management for many farmers of the Okayama Plain. Rice and wheat crops of the paddies provide the family food needs, while fruit is the principal source of income. The combination of these two has been so successful that it is the dominant land-use pattern in the hilly areas of the plain.

The principal markets for Okayama fruits are the large cities located in the commercial and industrial belt which stretches from Tokyo to Nagasaki. The Okayama Plain is advantageously situated in about the middle, and therefore the markets are widespread. An active marketing organization vigorously promotes sales.

The rise and successful development of the fruit industry on the Okayama Plain resulted from many factors, but the main ones were: the favorable physical environment, the demand for fruit in the large cities, the tradition for quality fruit, and the existence of an active marketing organization. Microfilm $2.45; Xerox $8.60. 188 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ISAIAH BOWMAN: BACKGROUNDS OF HIS CONTRIBUTION TO THOUGHT

(L. C. Card No. Mic 58-5208)

George Arthur Knadler, Ed.D.
Indiana University, 1958

Chairman: Howard T. Batchelder

The purpose of this research has been to evaluate the life and works of Isaiah Bowman as geographer and educator against the background of evolving geographic thought.

Procedures of study included: (1) Library research in the history and philosophy of geographic thought. (2) Analysis of the major items in Bowman's nearly two hundred books, articles, and addresses. Many of these are available only at The Johns Hopkins University Library where reprints of most of his writings are bound in six volumes entitled Isaiah Bowman's Collected Papers. (3) Examination of correspondence files covering thirty-three years of Isaiah Bowman's life. This was done at the American Geographical Society of New York for the years 1915-1935 and at the office of Robert G. Bowman (Isaiah's son) at the University of Nebraska for the years 1935-1948. (4) Interviews and correspondence with leaders at the American Geographical Society of New York and with leaders in the geographical profession at large who worked with Bowman or knew him well.

Summary of findings: Isaiah Bowman was a sturdy and outstanding American pioneer in the history of geographic thought. He was born in Waterloo, Ontario, Canada, in 1878, and upon graduation from Harvard in 1905 began teaching at Yale University. In 1915 he became director of the American Geographical Society of New York, a research institution, and in 1935 he became president of The Johns Hopkins University, serving until he retired at the age of seventy in December, 1948.

Substantively Bowman contributed to physical geography in writing Forest Physiography (1911), to regional geography with his Andes of Southern Peru (1916) and Desert Trails of the Atacama (1924), and to political geography with his The New World (four editions, 1921-1928). In 1925 he initiated through the Division of Geology and Geography in the National Research Council, his "pioneer fringe" thesis, developed to make the task of settling new areas less hazardous for the modern pioneer. As a result of the research on this thesis Bowman's own Pioneer Fringe as well as a composite volume by many regional experts, Pioneer Settlement, appeared in the early thirties.

In methodology Bowman's main work was Geography in Relation to the Social Sciences (1934), written as one of the volumes in the report of the Commission on the Social Studies of the American Historical Association. Also, much of his social and educational philosophy emerges in addresses and reports to the Board of Trustees during his Johns Hopkins years as well as in his The Graduate School in American Democracy (1939).

Isaiah Bowman's contribution included service to his country in two world wars. For most of a year's preparation for the Paris Peace Conference he directed a research team (the so-called "Inquiry") and subsequently spent almost nine months in Paris as Chief Territorial Advisor. In World War II he was an advisor in the State Department for over three years and is considered one of the architects of the United Nations charter.

In conclusion it can be said that Isaiah Bowman made a very considerable contribution to geographic thought and is worthy of full scale biographical treatment, especially when the confidential files at Johns Hopkins, closed until 1975 by the terms of his will, are available. Bowman was both a significant producer of research in several fields of geography and a very successful leader of research-producing institutions. He was an important advisor to two Presidents of the United States. Microfilm $3.30; Xerox $11.20. 255 pages.

GEOLOGY

STRATIGRAPHY AND TEXTURE OF THE SALEM LIMESTONE IN SOUTHWESTERN ILLINOIS

(L. C. Card No. Mic 59-471)

James Watson Baxter, Ph.D.
University of Illinois, 1958

The Salem Limestone crops out in and adjacent to the Mississippi River bluffs in southwestern Illinois. Limestone beds of diverse character constitute the formation. The southwestern Illinois Salem is herein subdivided into four members to which the names Kidd, Fults, Chalfin, and Rocher are assigned. These members have compositional and textural attributes which are diagnostic of the individual subdivisions and for the environment of deposition which is related to a gradual change from an open marine environment to a semi-restricted one similar to that now existing in the interior parts of the Great Bahama Banks.

The Kidd Member is a skeletal calcarenite composed of medium- to coarse-grained crinoid columnals and fine bryozoan debris. It was deposited in an open marine environment in which normal salinity and carbonate concentration were maintained.

The Fults Member consists of alternating beds of fine-grained, dolomitic limestone and beds which contain admixtures of skeletal debris and microcrystalline, non-skeletal grains. The Fults Member was deposited during an unstable period related to gradual restriction of the area. The restriction was probably initiated by minor uplift of the land area which also resulted in the deposition of land derived silt and clay in the lower part of the member.

The Chalfin Member is composed of calcilutites, calcisiltites, and calcarenites containing a predominence of microcrystalline, non-skeletal grains believed to have been formed by the progressive cementation of chemically precipitated carbonate. They were probably deposited under semi-restricted conditions of limited local turbulence and supersaturation for carbonate.

The Rocher Member is a skeletal calcarenite in which the tests of Endothyra are a prominent element. Commonly the Rocher is more or less oolitic, in some localities being largely composed of oolites. Oolites were formed where supersaturation with carbonate was coupled with minor local turbulence.

The relationships of the southwestern Illinois Salem area to the Salem encrinites of southern Illinois and to the dolomite and siltstone near shore facies of western Illinois suggests that deposition occurred on a gently shelving coastal shoal. Microfilm $2.00; Xerox $5.20. 103 pages.

A STUDY OF IRON SILICATE MINERALS IN IRON-FORMATIONS OF THE LAKE SUPERIOR REGION, WITH EMPHASIS ON THE CUYUNA DISTRICT, MINNESOTA

(L. C. Card No. Mic 59-1252)

Rolland Laws Blake, Ph.D.
University of Minnesota, 1958

Samples studied consist of relatively unoxidized silicate-rich iron-formation from the Cuyuna and Mesabi districts in Minnesota, and from the Marquette and Menominee districts in northern Michigan.

The thin-bedded silicate-rich facies of the main iron-formation in the Cuyuna district was deposited as a chemical precipitate, and it now is composed of the following minerals, in approximate order of decreasing abundance: Fe-Mn carbonate, stilpnomelane, minnesotaite, magnetite, quartz, a 14 A iron silicate, a 7 A iron silicate, goethite, hematite, pyrite, and very locally, amphibole and arsenopyrite. Structures and textures suggest that certain layers along primary bedding have been affected by recrystallization and chemical reconstitution, the latter process developing minnesotaite apparently at the expense of stilpnomelane. Where secondary rock cleavage is developed, much coarse minnesotaite is oriented along cleavage traces in nematoblastic texture. This minnesotaite probably formed at the time stresses developed cleavage. The gentle to tight folding, development of rock cleavage, and the recrystallization and chemical reconstitution of some of its minerals, suggest that the main iron-formation in the Cuyuna district was involved in low grade regional metamorphism.

Green Fe''-rich stilpnomelane was observed slightly oxidized to the brown variety. Brown stilpnomelane is predominant near iron ore deposits suggesting that oxidation which produced ore has oxidized much originally green stilpnomelane to the brown variety.

In all four iron districts the iron-formations contain fracture-fillings or pods of predominantly stilpnomelane and quartz which were deposited from solutions possibly originating within iron-formation by the process of metamorphic differentiation.

Spectrographic analysis of greenalite from the Mesabi district showed only the elements found in ordinary chemical analysis.

Chemical analyses and refractive indices were determined on three stilpnomelane samples from the Cuyuna district. Refractive indices for each sample are variable (probably a function of varying Fe''/Fe''' ratio); their approximate mean indices fall somewhat above Hutton's curves of indices vs. chemical composition for stilpnomelane. Formulas for each stilpnomelane were calculated by four methods. The following average formula was calculated using Gruner's method:

$$(OH, O)_6\ (K, Na, Ca)_{0.4}\ (Fe, Mg, Mn, Al)_{6.6}\ Si_8\ O_{20} \cdot 2.3\ H_2O$$

Spectrographic analysis of four stilpnomelane samples detected Sr and Ti in two of them and Ba in all four. Ammonia was detected by odor and confirmed chemically in amounts up to 0.22 percent in the mineral stilpnomelane from fracture-fillings and iron-formation from open pits, and detected by odor in exploration drill core samples from the Cuyuna district. The spacings of two prominent X-ray reflections of stilpnomelane at approximately 1.57 A are thought to vary with the ratio of Fe''/Fe''' because of the difference in their ionic radii. X-ray reflection measurements on eight analyzed stilpnomelanes suggest that the FeO/Fe_2O_3 ratio may be estimated within $\pm$ 20 percent. Ethylene glycol did not expand the stilpnomelane structure. DTA curves for the three analyzed stilpnomelanes are presented.

Chemical and optical properties of minnesotaite from a fracture-filling in the main iron-formation of the Cuyuna district are similar to those given by Gruner. The structural formula was computed using two methods; that of Stevens gave:

$$(OH)_{5.4}\ (Fe'', Mg, Mn)_{5.7}\ (Al, Fe''')_{0.16}\ (Si_{7.9}Al_{0.1})_{8.0}\ O_{20}$$

The minnesotaite structure did not expand when treated with ethylene glycol. Comparison of DTA curves for minnesotaite and talc show that reactions start at a lower temperature in minnesotaite.

Soft green Fe-Al silicate with a 7 A structure was found in the Biwabik iron-formation. Chemical analysis, optical properties, DTA, and X-ray diffraction suggest that the material may be a chamosite, or a mixture of kaolinite and chamosite or of kaolinite and greenalite. Ethylene glycol did not expand the structure or indicate a mixed layer structure. Microfilm $2.00; Xerox $7.00. 147 pages.

GEOLOGY OF THE STATE OF MORELOS AND CONTIGUOUS AREAS IN SOUTH-CENTRAL MEXICO

(L. C. Card No. Mic 59-923)

Carl Fries, Jr., Ph.D.
University of Arizona, 1958

The area described lies in south-central Mexico and embraces all but the southeastern corner and easternmost border of the State of Morelos, the second smallest State in the Mexican Republic. It includes small contiguous parts of the State of México, in the northeastern corner, and of the State of Guerrero in the southwestern corner. Limiting geographic coordinates are 98°45' to 99°39' west longitude and 18°18' to 19°08' north latitude, the northern boundary being only 35 km. south of Mexico City, capital of the Republic. The geologic map does not cover the entire rectangle outlined, but is irregular in form and measures roughly 4150 sq. km., three-quarters of it representing two-thirds of the State of Morelos and the rest lying outside the State.

The region ranges in altitude from 730 m. above sea level at Iguala near the south edge of the map, to a general level of about 3000 m. at the north edge, although individual peaks rise to 3900 m. and Popocatépetl Volcano, a few kilometers east of the northeastern border of the map, rises to 5452 m. above sea level. Annual rainfall ranges from a minimum of about 640 mm. in the low country, to 1200 mm. and more at altitudes above 2000 m. Most of it falls in summer between June and September. Winter frosts are rare below 1800 m. The climate is of savanna to steppe type; soils are thin and may be classified as belonging to the tschernosem group, with strong development of calcareous evaporites (caliche) at altitudes below 1800 m.

The northern border of the area forms the southern half of the late Pliocene to Recent Neo-volcanic Belt of basic volcanism that crosses Mexico in the direction N. 80° W., and thus has constructional topography. The rest of the area belongs to the Balsas Basin physiographic province, which is characterized by maturely dissected terrain tributary to the large Balsas River. All but the southwestern corner of the area drains southward via the Amacuzac River into the Mexcala-Balsas River, and thence westward into the Pacific Ocean. The southwestern corner drains directly into the Balsas River via the Iguala River. Local relief is of the order of 300 to 600 m. The mature topography was partly buried by late Pliocene alluvium in the central part of the area, owing largely to local volcanism. Dissolution of limestone, dolomite, and anhydrite of the Cretaceous formations has produced sinks and poljes, some of which contain small lakes. Other karst features are also common, such as caves, caverns, underground rivers, and surficial lapies or karren. Drainage blocking by lava and polje development in late Pleistocene and Recent time produced new alluvial flats in this otherwise dissected region.

The oldest rock unit in the region is the Taxco schist series of late Paleozoic(?) age. It was folded, metamorphosed, foliated, intruded by dikes, and strongly eroded before the next unit, the Taxco Viejo green volcanic series of Late Triassic(?) age, was deposited. Another period of metamorphism and erosion followed before the calcareous clastic sediments of the Upper Jurassic(?) Acahuizotla formation were laid down. The next unit consists of the partly phyllitic calcareous shale of the Acuitlapán formation, which is of Neocomian(?) age and rests with at least disconformity on the Acahuizotla formation. The overlying Aptian-Barremian Xochicalco formation of thin-bedded limestone appears to grade upward from the Acuitlapán formation, locally, but it seems to be unconformable elsewhere. All these units have small outcrops in the area mapped and were not studied in detail.

Warping and erosion occurred before the overlying Morelos formation began to accumulate in early Albian time. The basal member is anhydrite in the eastern part of the area mapped, but limestone and dolomite were deposited elsewhere. The formation consists largely of shallow-water calcareous bank deposits, with a maximum thickness of about 900 m. Deposition ceased in early Cenomanian time and further warping occurred, possibly accompanied by intrusion of the Coxcatlán, Buenavista, and Colotepec granitic stocks. The next formation consists of the Cuautla limestone of Turonian age, which rests disconformably upon the Morelos formation. It represents a thick calcareous bank (750 m.) in the eastern half of the area mapped, but westward it wedges out and interfingers with the overlying calcareous clastic sediments of the Mexcala formation, which may be of latest Turonian age at the base in some places and of early Coniacian age elsewhere. The Mexcala formation is at least 1200 m. thick and accumulated until Santonian or possibly Campanian time, when the region was uplifted and was not again submerged.

A period of strong folding occurred probably in early and middle Eocene time, concomitant with the Laramide folding farther north. As folding tapered off, intrusion of dikes and stocks, strong faulting, and extrusion of basic lavas began, accompanied by accumulation of thick (more than 2000 m.) clastic deposits of the Balsas group on downfaulted blocks in latest Eocene and early Oligocene time. Rhyolitic volcanism then commenced in the south to form the Tilzapotla rhyolite series, and intermediate volcanism soon began all over the region, forming the Tepoztlán formation, Buenavista volcanic series, Zempoala andesite series, and other Undifferentiated volcanic rocks, all of latest Oligocene to earliest Pliocene age. Local unconformities developed between the units, and dikes and small stocks were emplaced here and there.

Renewed faulting, outbreak of Nevado de Toluca (Xinantécatl) and Popocatépetl Volcanoes, and accumulation of the Cuernavaca formation followed in middle and late Pliocene time. Basaltic volcanism then began in the Neo-volcanic Belt and cut off drainage from what is now the upper Lerma valley and the former Mexico valley, reversing drainage in the former and turning the latter into an endoreic basin. Deposition of the Cuernavaca formation was halted, and the basaltic range along the northern border of the area was built. The Neo-volcanic Belt is thought to be a part of Menard's Clarión fracture zone of the Pacific Basin, as already suggested by him, but its age inland is not believed to be older than middle Pliocene. The belt is thought to represent the surficial expression of incipient left-lateral transcurrent faulting in the subcrust. Activity continues along it to the present day.

Microfilm $4.95; Xerox $16.60. 387 pages.

GEOLOGY AND ORE DEPOSITS OF THE NORTHERN PART OF THE BIG INDIAN DISTRICT, SAN JUAN COUNTY, UTAH

(L. C. Card No. Mic 59-1514)

William Bacheller Loring, Ph.D.
University of Arizona, 1959

Supervisor: F. W. Galbraith

The Big Indian uranium district lies in northern San Juan County, in southeastern Utah, 33 miles southeast of Moab. The northern part of the district includes the North Alice, Far West, Radon and Cord mines. The district is on the Colorado Plateau.

A thick evaporite sequence was deposited in the Paradox basin during Pennsylvanian time. During the late Pennsylvanian, and through Permian time, red sands and shales from the Uncompahgre highland alternated with limestone, forming the "Rico" and Cutler formations. Post-Cutler doming, about a salt plug, resulted in a 3° unconformity with overlying Triassic Chinle sand and shale beds. Above the Chinle, the Wingate formation is composed of eolian sand; it is the main surface rock in the

district. The Jurassic is comprised of a thick sand section, - Kayenta, Navajo and Entrada, overlain by the Morrison formation, which consists of alternating sand and shale in the lower part and shale in the upper part. The youngest rocks in the district are Cretaceous, - Burro Canyon-Dakota sandstone, and Mancos shale. Most of the uranium is found near the base of the Chinle formation; there is some production from the Morrison Salt Wash member in outlying parts of the district, such as in the Rattlesnake mine, to the north.

Most of the structures are post-Mancos, - probably Laramide. An anticline, trending northwest, was localized by the earlier dome. Upward forces resulted in the Lisbon Valley fault along the axis of the anticline, with uplifting of the southwest, foot-wall block. This block was subdivided by a series of radial and concentric fractures, - faults and joints, centering on a point near the Lisbon Valley fault. In the hanging-wall block at this point, there is a copper deposit in the Dakota-Burro Canyon sandstone.

Uranium ore deposits were formed during the early Tertiary. In the foot-wall block, acid, reducing fluids moved out and up, along the fractures, removing calcite cement and bleaching the hematite; affecting in particular sandstone and arkose immediately above and below the Cutler-Chinle contact. Ore-bearing solutions followed the bleaching ones; pyrite, in sparse amounts, was deposited first, then pitchblende and calcite. The pitchblende occurs scattered through the calcite cement, and coating and replacing quartz grains; the calcite is colored pink from disseminated hematite. The bleaching may have been effected by a sulphur acid; and the ore emplacement by a carbonate solution, with a ferrous precipitant. Most of the ore is in Chinle sand laid down by braided streams, which flowed westerly from the Uncompahgre highland, and is found where these sands overlie the paleo-outcrop of a Cutler arkose bed. Where the Chinle sand is missing, ore may occur in Chinle siltstone, or in the top part of the Cutler.

Microfilm $2.60; Xerox $9.00. 197 pages.

THE GEOLOGY OF THE PACHECO PASS AREA, CALIFORNIA

(L. C. Card No. Mic 59-1445)

Elliott Bates McKee, Jr., Ph.D.
Stanford University, 1959

Supervisor: Ben M. Page

Pacheco Pass is in the Diablo Range approximately 80 miles southeast of San Francisco, California. The Pacheco Peak and a part of the Pacheco Pass 7 1/2 minute quadrangles were mapped.

Franciscan (Jura-Cretaceous ?) sedimentary, igneous, and metamorphic rocks form the core of the Diablo Range. At Pacheco Pass about 80-90 per cent of the rocks are marine sedimentary or altered sedimentary types. Predominant is a poorly sorted wacke, which is arkosic in the lower part of the section but contains abundant lithic detritus in the middle and upper parts. Siltstone, shale and discontinuous chert beds occur throughout the area. Conglomerate appears as lenses up to 200 feet thick in the lower part of the section. The total thickness of the Franciscan sequence in the Pacheco Pass area is probably greater than six miles, but neither the top nor the bottom is exposed.

Small basic lava flows and intrusions, altered to greenstone or locally serpentine, are common, especially in the lower part of the section.

Metamorphism was widespread in the area. Lawsonite has crystallized in the plagioclase grains and in the matrix of many of the sedimentary and igneous rocks. Jadeite and quartz have replaced the plagioclase in rocks throughout the southern and eastern part of the area, and this alteration extends an unknown distance to the north, east, and south. The regional development of jadeite has not been reported previously anywhere in the world. Glaucophane commonly accompanies jadeite in the Pacheco Pass area, and more completely recrystallized glaucophane-bearing and associated metamorphic rocks have developed where aided by fluids and shearing.

Slightly folded erosional remnants of andesite and basalt flows of the Quien Sabe group (late Cenozoic) locally lie with angular unconformity on the Franciscan rocks.

The Franciscan sequence has a moderate regional dip to the east; the oldest rocks thus crop out in the western part of the area. This is complicated by intricate local folding and by numerous mylonitized shear zones which trend generally east-west.

The source of the clastic sediments of Pacheco Pass is unknown, but a sodic quartz diorite and Franciscan rocks contributed much detritus. Chert probably was precipitated organically and inorganically, and some of the silica was probably derived from contemporaneous volcanism. Metamorphism of the sediments at a low temperature and a moderate pressure began before the climax of folding and faulting. This climax probably occurred prior to the deposition of Late Cretaceous sediments east of Pacheco Pass.

The Franciscan rocks were uplifted, tilted, and deeply eroded before late Cenozoic burial beneath Quien Sabe lavas. Erosion has largely removed these flows, and the present topography indicates a recent increase in the rate of erosion throughout the area.

Microfilm $2.00; Xerox $5.60. 115 pages.

GEOLOGY AND GROUND WATER RESOURCES OF THE CARLSBAD AREA, NEW MEXICO

(L. C. Card No. Mic 58-5462)

Ward Sundt Motts, Ph.D.
University of Illinois, 1957

This report describes the geology and ground-water conditions of an area of about 1,600 square miles in southwestern Eddy County, New Mexico. The area lies partly in the Guadalupe Mountains, in the Basin and Range physiographic Province, and partly in the Pecos Valley and adjacent land to the east, in the Great Plains Province. The geology was studied over an area of 1,600 square miles and mapped in detail over 510 square miles.

The area is underlain by carbonates, sandstones, shales, and evaporites of Permian age and gravels, sandstones, and conglomerates of Tertiary and Quaternary age. Sedimentation in Leonard and Guadalupe time was characterized by a reef environment which separated water in the deeper Delaware Basin from water in the shallow shelf lagoon. Time-rock units of Leonard and Guadalupe age consist of

a basin facies of quartzose sandstone, black limestone, a reef facies of massive limestone and a shelf facies. The shelf facies is divided into a carbonate facies consisting of limestones and dolomites interbedded with brown sandstones and siltstones, and an evaporite facies consisting chiefly of anhydrite and gypsum interbedded with red sandstone and siltstone.

The exhumed Guadalupian reef, which extends as a prominent escarpment from New Mexico into Texas, plunges into the subsurface in the vicinity of Carlsbad, New Mexico. To the west of the escarpment lies the mountainous Guadalupe upland of the shelf, underlain by rocks of Leonard and Guadalupe age. To the east of the escarpment lies the lowland area underlain in the area of investigation by rocks of Ochoa age and Tertiary and Quaternary alluvium. A series of surfaces rising in increasing elevation from the Pecos River are the Lakewood terrace, Orchard Park and Blackdom Plains and the higher areas south of Black River.

Surface and subsurface studies during this investigation indicate that the upper San Andres formation is of Guadalupe age and the lower San Andres is of Leonard age. Following established usage the Queen and Grayburg formations of the shelf facies are considered to be equivalent to the Goat Seep formation of the reef facies and the Cherry Canyon formation of the basin facies; and the Tansill, Yates, and Seven Rivers formations of the shelf facies are considered to be equivalent to the Capitan formation of the reef facies and the Bell Canyon formation of the basin facies. Overlying rocks of the Guadalupe series are in increasing age the Salado, Rustler, and Dewey Lake formations which are included in the Ochoa series. The next youngest rocks in the area of investigation are siliceous residual gravels which are of Pliocene (Ogallala) age or early Pecos River deposits of Pleistocene age. They are succeeded by older alluvium with a maturely-weathered caliche profile and younger alluvium with a younger-weathered caliche profile.

The occurrence and movement of ground water in Permian rocks are determined by the lithologic facies. Aquifers in strata of the shelf and reef facies are intimately related, and together form the limestone aquifer system. From the recharge area in the mountainous shelf region, ground water percolates slowly through the shelf beds to the highly cavernous and permeable reef zone, then is forced to flow northward because of barriers of the underlying Cherry Canyon sandstone and adjoining Castile anhydrite. This water eventually discharges at Carlsbad Springs a few miles north of Carlsbad, N. Mex.

In the shelf area ground water is present in caverns along joints and bedding planes in limestones, dolomites, and evaporites above relatively impermeable sandstone and siltstone beds. Generally the movement of the perched water follows the regional dip of the beds. Because exposed rocks of the evaporite facies are composed principally of gypsum which is easily soluble by ground water, rocks of the evaporite facies have greater permeability than those of the carbonate facies. In places ground water is forced upward at the carbonate-sulfate contact to form such springs as Major Johnson Springs and Indian Big Springs. The porosity and permeability of rocks of the carbonate facies increases toward the reef in part because of an increase in the calcareous content and the coarser texture of the carbonates.

Structures studied in this report include arcuate folds parallel to the reef trend in the shelf area, mound structures superimposed on these folds, a large east-west fold present southwest of Carlsbad in the shelf area, and a fold parallel to the reef escarpment in the beds of the Delaware Basin. The mound structures are considered to be of biohermal origin. In the northern Delaware Basin this mound-reef development was present rather than barrier reef conditions which existed in the southern part of the basin. A broad syncline extends through Dark Canyon, that probably was present through much of Guadalupe time and ultimately determined part of the course of Dark Canyon.

The Lakewood, Orchard Park and Blackdom terraces were mapped and correlated by topographic position and maturity of caliche profile. In the Carlsbad alluvial basin thickening of alluvium occurs in areas underlain by evaporite rocks and thinning of alluvium occurs over limestone bedrock. The irregular bedrock surface is not considered the result of fluvial erosional processes but of solutional activity accompanied by contemporaneous deposition of alluvial materials from the Pecos River and its tributaries. During this process the more soluble constituents are gradually carried away and the reddish insoluble silt and clay left behind form a relatively impermeable barrier that prevents further solution of the underlying evaporites. Ground water, which occurs in the alluvial materials above the insoluble residue, is important to agriculture as an adjunct to surface water in this area.

The discovery of a piezometric surface below the lowest known cavern level in the Capitan formation and other geologic findings give new evidence as to the time of formation of the Carlsbad Caverns. An older report places the time of cave formation as pre-Ogallala, which antedates the present topography and drainage. The present report presents evidence that the cave formation is continuing at the present time and indicates that the deeper cavern levels, as seen in the Carlsbad Caverns, were formed in post-Ogallala time. The extensive solutional activity by ground water which formed the caverns followed regional uplift, trenching of the Pecos River into rocks of Guadalupe age, and draining of the stagnant, highly mineralized interstitial water into the Pecos River.

Microfilm $2.25; Xerox $8.00. 171 pages.

GENERAL GEOLOGY OF THE ISABEL-EYLAR AREA, CALIFORNIA, AND PETROLOGY OF FRANCISCAN SANDSTONES

(L. C. Card No. Mic 59-284)

Soliman Mahmoud Soliman, Ph.D.
Stanford University, 1958

The main purpose of this work is to study the petrology of Franciscan sandstones on local and regional bases.

In the Isabel-Eylar area (Isabel Valley and Eylar Mtn. 7-1/2-minute quadrangles) two principal stratigraphic divisions of the Franciscan group were recognized. The Lower Unit (minimum thickness 7000 ft.) consists chiefly of alternating thin beds of fine arenite, siltstone, and shale. These rocks show primary sedimentary structures which are best explained by assuming that sedimentation occurred principally as a succession of turbidity currents spreading out over the floor of a depositional trough. The upper part of the Lower Unit has an abundance of small coarse-grained

sandstone lenses, glaucophanite, and greenstone with minor associated chert.

The Upper Unit (minimum thickness 3000 ft.) consists largely of massive, coarse-grained graywacke. Lenses of conglomerate and chert are abundant, and greenstones and glaucophanite are common near its base. Parts of the graywacke show alteration to jadeitite.

The greenstone indicates a series of minor volcanic eruptions accompanying deposition. Intrusive serpentine occurs on the edges of two masses lying mainly in adjacent quadrangles. Chert accompanying the greenstone may have had a volcanic source; the chert of the Upper Unit, largely independent of greenstone and containing abundant radiolaria, is more probably of organic origin. Glaucophanite and jadeitite occur as lenticular masses; jadeite and lawsonite are also widely disseminated as a replacement in sandstone. The associations and composition of the metamorphic rocks make it probable that most of the glaucophanite is metamorphosed greenstone and most of the jadeitite metamorphosed graywacke.

The general structure of the area is simple, consisting of broad open folds trending roughly northwest with two zones of complex structure and many faults. Structures in the Lower Unit are locally very complex on a small scale, both because of slumping during deposition and because of later tectonic deformation.

Franciscan sandstones over a wide region in central and northern California are strikingly similar to the arenites and graywackes of the Isabel-Eylar area. The most abundant grains are quartz, sodic plagioclase, chert and fragments of volcanic rock; the matrix amounts to 4-26% of the rock. Grain counts show regional variations that provide clues to the provenance and direction of movement of the original sediment. Epidote, chert, and volcanic fragments become more abundant northward from the Diablo Range, plagioclase and quartz less abundant. Epidote is conspicuously less common in the Diablo Range than in the mountains nearer the coast. In northern California, this deficiency generally coincides with scarcity of K-feldspar. In general, the progression is from less mature to more mature sediments in a north to south direction. This could be explained by local derivation of the sands from different kinds of rock, but may also indicate filling of the Franciscan marginal trough largely from the northern end and partly from the eastern side. The latter hypothesis is supported by measurements of current direction from sedimentary structures in the Isabel-Eylar area, and likewise by mineralogic similarity between the Franciscan sandstones and the older rocks of the Klamath Mountains at the north end of the Franciscan trough. Some local derivation of material is indicated by rare grains which are distinctive of the Sur series, in the sandstones of the Diablo Range.

Microfilm $2.30; Xerox $8.00. 174 pages.

HEAVY MINERALS OF SOME GRANITIC ROCKS OF CENTRAL CALIFORNIA

(L. C. Card No. Mic 59-1454)

John Hugh Spotts, Ph.D.
Stanford University, 1959

Studies of heavy mineral concentrates and thin sections from a series of granitic plutons in the Coast Ranges of central California and the Farallon Islands have been made to test the possibility of correlation of these masses by accessory minerals. Characteristic mineral assemblages for the major rock types are as follows: apatite-sphene-epidote-clinozoisite-allanite-zircon in quartz diorite, the most abundant rock type, and in closely associated granodiorite and adamellite; garnet-zircon-monazite-xenotime in granite; and brown hornblende-ilmenite-cummingtonite-apatite in gabbro. Heavy minerals from the large bodies composed essentially of quartz diorite show general similarity but wide variations in total and relative amounts. Definite correlations are uncertain because of the lack of any unique characteristics of the suites compared to accessory minerals of granitic rocks in general. Statistical measurements of zircon elongation, analyzed by reduced major axis and elongation frequency techniques, are interpreted as indicative of two separate crystallization histories for quartz diorite throughout the region studied, with possible correlations between intrusions forming segments of the separate areas. A distinctive elongation trend for zircon in granite represents crystallization under different conditions. Zircon in gabbro and in mafic inclusions in the quartz diorite is predominantly anhedral in contrast to euhedral zircon in granitic rocks. Zircon morphology and mineralogy of other accessories suggest that mafic inclusions are fragments of basic igneous rocks, possibly cognate in origin.

Microfilm $2.00; Xerox $5.60. 111 pages.

THE PETROLOGY OF THE CHIPMUNK SAND AND ITS RELATIONSHIP TO RESERVOIR PROPERTIES

(L. C. Card No. Mic 59-776)

Frank L. Stanonis, Ph.D.
The Pennsylvania State University, 1958

The Chipmunk sand of New York State is one of the oldest oil producing sands in the United States. The sand is located in the northwestern section of the Bradford Field area where the Chipmunk sand produces oil from an area of approximately eight square miles. While the Chipmunk sand was second only to the Bradford Third sand, as far as oil production was concerned in this area, it does not possess equal oil producing propensity over its entire pool area. The sand apparently ranges from an excellent reservoir rock to a rock which does not produce oil economically. For the purpose of this investigation this range of productivity was broken down into three parts: a "good" reservoir type; a "medium" reservoir type; and a "poor" reservoir type. The reason for this difference in productivity was then sought after by the study of samples obtained from these three reservoir types. The study revealed that for each of these types the petrologic characteristics differed in some respects but more important the relationships which exist between petrographic characteristics and reservoir properties differ.

Regression analysis shows that the long and short axes of the quartz grains have more to do with porosity and permeability in the "poor" sand than does sorting, matrix, or cementation. As the quartz grains become smaller and more spherical the porosity and permeability improve.

In the "good" sand, silica cement plays the important role in determining porosity and permeability. As the amount of silica cement decreases both porosity and permeability improve. As the matrix content increases, in the "medium" sand, porosity improves, this being the more important variable as far as porosity is concerned. As the size of quartz grains decreases the permeability improves. After establishment of the fact that the petrographic characteristics influence the reservoir properties of a rock, discriminatory analysis was employed, utilizing the significant petrographic characteristics, to classify numerically a sample of reservoir rock and fit its value to the scale between the "poor" and "good" ends of the productivity range.

Discriminatory analysis showed that the wells could be classified according to their oil producing capability but that a larger number of samples from a well is necessary to prevent misclassification.

The use of methods of analysis similar to those employed in this work will find varied and useful application in the search for and study of "stratigraphic" type oil reservoirs. Microfilm $2.15; Xerox $7.60. 162 pages.

THE ALBERTA GROUP AND EQUIVALENT ROCKS, ROCKY MOUNTAIN FOOTHILLS, ALBERTA [AND] APPENDICES

(L. C. Card No. Mic 58-7892)

Donald Franklin Stott, Ph.D.
Princeton University, 1958

The Alberta group and equivalent rocks, consisting of Upper Cretaceous marine sandstones and shales, have been studied in the Alberta Foothills along the Canadian Rocky Mountains between latitude 49° and 54°.

The Alberta group consists of the Blackstone, Cardium, and Wapiabi formations for which type sections are defined. Equivalent beds overlying the sandstone of the Dunvegan formation in the northern Foothills have been included in the Smoky group which contains the Kaskapau, Cardium, and Wapiabi formations. Shales of the Fort St. John group lying beneath the Dunvegan formation are shown to be equivalent to the basal beds of the Blackstone formation. The Blackstone formation, consisting predominantly of marine shale, contains the Sunkay, Vimy, Haven, and Opabin members. The Cardium formation, distinctive for its marine sandstones, also contains nonmarine beds which increase in thickness towards the northwest. The Cardium formation consists of the Ram, Moosehound, Kiska, Cardingal, Leyland, and Sturrock members. The Wapiabi formation contains sideritic and calcareous shales and sandstones which are included in the Muskiki, Marshybank, Dowling, Thistle, Hanson, Chungo, and Nomad members. The upper three members of the Wapiabi formation are equivalent to the basal beds of the Belly River formation in southern Alberta.

Cyclic sedimentation is evident in these rocks and two major cycles are defined: the basal one consists of the shales of the Blackstone formation and sandstones of the Cardium formation; the upper cycle consist of the shales of the Wapiabi formation and the sandstones of the Chungo member. These major cycles contain minor cycles which in turn are composed of subcycles. Sideritic shales of these cycles were deposited under restricted conditions in a shallow epicontinental sea, but calcareous shales were formed under more normal marine conditions. At the top of the major cycles in the Cardium and Chungo members, sediments of brackish or lagoonal environments and of the epineritic zone are recognized.

This Cretaceous sequence contains rocks which range in age from the late Albian Neogastrophiles zone to possibly as high or higher than the Campanian Scaphites hippocrepis zone. Major advances of the sea occurred in early Turonian and early Santonian time. Major retreats of the sea occurred in late Turonian and late Santonian time.

The Cardium formation, which in the Pembina field forms one of Canada's largest potential petroleum reservoirs, has prospects of providing greater reserves than presently known.

Microfilm $9.45; Xerox $33.80. 748 pages.

REACTIONS IN KAOLIN-TYPE MINERALS AT ELEVATED TEMPERATURES AS INVESTIGATED BY CONTINUOUS X-RAY DIFFRACTION

(L. C. Card No. Mic 59-593)

Floyd Michael Wahl, Ph.D.
University of Illinois, 1958

The influence of twenty-two chemical impurities upon the formation of high-temperature minerals from kaolinite-type structures was examined by continuous X-ray diffraction while the treated material was being heated. The growth of secondary mullite and cristobalite was recorded on diffractograms by traversing the 2θ range containing the (120) and (111) reflections of mullite and cristobalite respectively. The intensities of these diagnostic peaks were plotted against the temperatures at which they occurred. The resultant plots are growth curves for the phase minerals developed from each clay mixture.

The initial temperature of formation of secondary mullite and cristobalite from kaolinite and halloysite can be either raised or lowered by ionic impurities. Observed effects are coincident with changes in the thermal curves of these treated materials. Any lowering of the initial temperature of formation of either secondary mullite or cristobalite is accompanied by a comparable lowering of the temperatures of the exothermic peaks representing these reactions on the thermal curves.

The development of mullite is a two-stage process. Nucleation of primary mullite normally occurs between 950° and 980° C and is a rapid reaction involving a shifting of already articulated structural units. This transformation does not involve all the alumina in the system. That which remains is poorly-ordered and does not combine with free silica until a higher temperature is reached, at which time secondary mullite crystallizes. Following this reaction any remaining free silica crystallizes as cristobalite.

Poorly-ordered kaolinite and halloysite form less primary mullite than does well-crystallized kaolinite. They contain more uncombined, poorly-ordered alumina following primary mullite nucleation, and thus show an earlier development of secondary mullite than does well-crystallized kaolinite.

Ionic impurities can either enhance or block the reorganization of poorly-ordered components following initial primary mullite crystallization. Secondary mullite crystallization is enhanced by Mg^{++}, Fe^{+++}, Pb^{++}, Bi^{+++}, B^{+++}, and Ca^{++}. It is retarded by the alkaline ions. Cristobalite crystallization is enhanced by Mg^{++}, Fe^{+++}, Pb^{++}, Bi^{+++}, Ca^{++}, and P^{5+}. It is, however, completely blocked by alkaline ions. The ion P^{5+} has the greatest mineralizing effect on cristobalite crystallization and promotes the formation of this mineral from halloysite and a fire clay. These two materials do not normally develop cristobalite.

The effects of ionic mineralizers are subdued in poorly-ordered kaolinite and halloysite because more uncombined poorly-ordered alumina and free silica remain in these systems following primary mullite nucleation. Thus, the ionic mineralizers have less work to do in bringing about secondary mullite and cristobalite crystallization.

The effects of ionic mineralizers on the formation of new minerals from kaolinite-type clays are considered with respect to published phase diagram data derived from synthetic mixtures of pure oxides. Collected data on the formation of phase minerals in the presence of impurities are not always in accord with the oxide data. It is therefore suggested that silicate minerals such as cristobalite are not good "geological thermometers" and should not be used as indicators of the temperature of formation of a rock.

The influence of small amounts of certain chemical impurities are listed and it is suggested that the addition of phosphoric acid to kaolinitic clay materials before firing can lead to a more economical firing of clay products.

Microfilm $2.00; Xerox $4.80. 94 pages.

THE GEOLOGY OF THE SCHOOLHOUSE MOUNTAIN QUADRANGLE, GRANT COUNTY, NEW MEXICO

(L. C. Card No. Mic 59-1511)

Joseph George Wargo, Ph.D.
University of Arizona, 1959

Supervisor: R. L. DuBois

The Schoolhouse Mountain quadrangle is bounded by Lat. 32° 45'--32° 52' 30" N; Long. 108° 30'--108° 37' 30" W, and is located in northern Grant County, New Mexico, approximately 20 miles west of Silver City.

Volcanic pyroclastics and flows crop out in the northern part of the area. These rocks have been divided into nine formations containing 24 members. The lowermost units are andesites. The andesites are overlain by a thick series of pyroclastics and flows of rhyolitic composition. The rhyolites are overlain by a thin basalt flow. Precambrian granite and amphibolite overlain by Cretaceous sediments crop out in the southern part of the quadrangle.

Two major faults are found in the area; the north-south trending Schoolhouse fault and the east-west trending Wild Horse fault. A broad, complex arch trending in a north-northwest direction crosses the quadrangle.

A study of: (1) magnetic susceptibilities, (2) chemical compositions and (3) refractive index of fused rock reveals a means of distinguishing between some of the volcanic units that appear identical in the field. Closely spaced sampling and adequate geologic control are important to a successful application of these three correlation methods.

Microfilm $3.20; Xerox $11.00. 248 pages.

GROUND VIBRATIONS FROM A PERIODIC SOURCE

(L. C. Card No. Mic 59-781)

Robert Joseph Watson, Ph.D.
The Pennsylvania State University, 1958

Measurements of steady state vibrations produced by a mechanical vibrator over the frequency range 40-80 cycles per second have been made on a sandy shale in an unused strip mine near Philipsburg, Pennsylvania and also on a loose sandy soil near State College, Pennsylvania. Values of the attenuation exponent were obtained on the shale assuming a divergence factor of 1/2 for the spreading waves. The attenuation exponent was found to increase as the 0.9 power of frequency for both the vertical and longitudinal components, and can be expressed as $\alpha = 0.96 \times 10^{-3} f^{0.9}$ for the frequency range 40-80 cycles per second. Although measurements were made for three components of particle velocity, the transverse component was weak and sporadic at most distances and could not be used for determination of attenuation.

Observed fluctuations in the amplitude-distance curves could best be explained in terms of interference of waves emanating directly from the source. Coupling difficulties appeared to be the primary cause of scatter in amplitude measurements on the sand, precluding their use for determination of attenuation exponents.

Microfilm $2.00; Xerox $6.00. 121 pages.

THE GEOLOGY OF THE KENNEBAGO LAKE QUADRANGLE

(L. C. Card No. Mic 58-3129)

Robert Jackson Willard, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor C. Wroe Wolfe

The Kennebago Lake quadrangle presents a maturely-dissected topography in an igneous-sedimentary terrain. Relief frequently exceeds 1000 feet, the maximum being 2610 feet. Mountainous masses are underlain by well-bedded quartz-rich meta-siltstones, quartz conglomerates, and trondhjemite intrusions. Valleys are developed on slates, equigranular granites, meta-limestones (?) and along transverse fractures. The regional drainage divide between the Androscoggin and Kennebec Rivers zig-zags in a south-south-east to north-north-west direction across the quadrangle, producing a general northeast or southwest flow of streams. Numerous swamps and marshes are scattered throughout the quadrangle.

Four formations of probable Silurian age make up an aggregate thickness estimated to be between 14,000 and 17,000 feet. They are:

Parmacheene formation	2000	200 ft. (estimated)
Perry Mountain formation	5000	500 ft. (estimated)
Johns Pond formation	1600	400 ft. (estimated)
Lost Brook formation	7000	500 ft. (estimated)

The Blanchard Pond marine fauna consist entirely of brachiopods: Coelospira cf. hemispherica (Sowerby), and an unidentified chonetid and strophomenid. C. hemispherica dates the lower portion (?) of the Perry Mountain formation as Middle Silurian (Clinton) age. This assemblage is unlike Niagaran assemblages to the northeast. The above strata are unlike the fossiliferous Lower Devonian rocks to the northeast, and appear to underlie them in the Spencer quadrangle.

The Lost Brook formation was originally a pelitic, argillaceous quartz silty clay derived from a humid land mass and transported during semi-aridity to a subsiding quiet basin. The Johns Pond formation probably consisted of basic (basaltic ?) lavas and interbedded basic tuffs (?) deposited in a subaqueous environment. The Perry Mountain formation is composed of basal conglomerates grading upward into cyclical argillaceous quartz silstones. The conglomerates may have been derived from an arid land mass, transported during a climatic shift towards humidity, and reworked by marine currents. The siltstones reflect the humid trend, and may have been deposited in a manner similar to that of glacial-lacustrine materials. The Parmacheene formation consists of carbonaceous argillaceous quartz silts derived from a humid land mass and transported in semi-(arid-humid) times to isolated basins. The sapropelic environment was conducive to the formation of sulphide material.

The Stratton-Kennebago granite is calci-alkalic and was forcibly intruded into the country rocks; it is of possible Upper Denonian to Lower Mississippian age. The ultramafic material on Boil Mountain was probably a plug of peridotite (dunite ?) now metamorphosed to a serpentinized talc-antigorite schist. The trondhjemite intrusions in the north may be related in time and space to nearby plutons either by the fusion of increasingly more acidic rocks or by progressive impoverishment in potash. They may be equivalent to the New Hampshire Plutonic Series.

The metamorphic grade of the pelitic and quartz-rich sediments of the Lost Brook, Perry Mountain, and Parmacheene formations is restricted to the chlorite and biotite zones of the greenschist facies. The Johns Pond formation passes from low grade greenstones in the north through hornblende-epidote-(albite or oligoclase) amphibolites to middle-high grade almandite-hypersthene-biotite-andesine granulites in the south. The Boil Mountain plug has suffered serpentinization probably by the addition of SiO_2 and H_2O plus the removal of MgO.

Regional northeast-southwest cleavage, schistosity, major folds, and inferred longitudinal faults are believed to have developed with orogenic (compressive) stresses. Northwest-southeast valleys may be zones of tensional weakness. Superimposed on these features is a probable complex of radial and tangential fractures associated with synkinematic intrusions.

Glacial deposits consist of unsorted sandy till, kames, valley alluvium, and an esker. Regional base levels include Long Falls Dam (Stratton) and Rangeley Lake (Rangeley). Microfilm $4.75; Xerox $15.80. 370 pages.

THE STRATIGRAPHY AND SEDIMENTOLOGY OF THE KAYENTA AND MOENAVE FORMATIONS, VERMILION CLIFFS REGION, UTAH AND ARIZONA

(L. C. Card No. Mic 59-1461)

Richard Fairfield Wilson, Ph.D.
Stanford University, 1959

The Vermilion Cliffs of northern Arizona and southern Utah lie between Lees Ferry, Arizona, in the southeast and Zion National Park, Utah, in the northwest. The cliffs are composed of strata of the Glen Canyon group of Triassic (?), Jurassic (?), and Jurassic age which overlie the Upper Triassic Chinle formation. Within the Vermilion Cliffs region, the Glen Canyon group consists of, in ascending order, the Moenave formation, the Kayenta formation, and the Navajo sandstone. The Wingate sandstone, the basal unit of the Glen Canyon group in areas to the east, is absent.

The Kayenta and Moenave formations were traced and studied by means of detailed measured sections, at intervals of 5 to 10 miles, from Lees Ferry to Zion National Park. As a result of this study, certain revisions of the established nomenclature for the Zion region (Gregory, H. E.: U. S. Geol. Survey Prof. Paper 220, 1950), and equivalent areas to the west and east, are made, including a redefinition of the Chinle formation to include only the lower part of the Petrified Forest member and the lower sandstones member of the Chinle as defined by Gregory, or all strata between the top of the underlying Shinarump conglomerate and an erosion surface from 150 to 250 feet below the base of the Springdale sandstone member of the Moenave formation.

The Moenave formation is equivalent to the upper part of the Petrified Forest member and to the Springdale sandstone member of Gregory's Chinle formation, and is subdivided into members. The Dinosaur Canyon member immediately overlies the Chinle formation, is composed of 140 to 230 feet of reddish brown sandstone, siltstone, and claystone, and becomes finer grained to the west. The Whitmore Point member, a unit of greyish to reddish siltstone and claystone with minor sandstone overlying the Dinosaur Canyon member in the west, tongues into beds of the basal Springdale sandstone member eastward along the Vermilion Cliffs. The Springdale sandstone, the uppermost member of the Moenave formation, is composed of 116 to 225 feet of reddish fine-grained sandstone and minor clay pellet conglomerate.

The Kayenta formation is redefined to include all strata between the top of the Springdale sandstone and the base of the Navajo sandstone, and embraces the upper sandstones of the Chinle, the Kayenta formation, and Wingate sandstone of Gregory for the western Vermilion Cliffs. It is composed predominantly of reddish sandstone in the east, and siltstone and claystone in the west. The Kayenta thickens from 100 to 200 feet in the east to over 1100 feet to the west of Zion. The top of the Kayenta intertongues with and pinches out into the aeolian Navajo sandstone in a northeast direction. The most prominent Navajo tongue occurs in the area around Kanab, Utah, and the eastern part of Zion Canyon, and is named Lamb Point tongue of the Navajo sandstone (Wingate sandstone of Gregory, 1950). The Lamb Point tongue is overlain by a complimentary tongue of the Kayenta formation (the Kayenta formation of Gregory,

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1950), to which the name Tenney Canyon tongue of the Kayenta formation is applied.

The Kayenta and Moenave formations, as well as the basal Navajo sandstone, contain similar mineral assemblages, and were probably derived from a similar source area. The westward decrease in grain size of various units suggests an eastern source, possibly in western Colorado.

The Kayenta and Moenave formations probably accumulated as stream channel, mud flat, and lacustrine deposits on a broad flood plain of low relief. Aeolian dune formation alternated with fluvial conditions during part of the period in which the Kayenta was deposited.

Microfilm $5.15; Xerox $18.20. 401 pages.

HEALTH SCIENCES

HEALTH SCIENCES, GENERAL

PERIPHERAL CIRCULATORY RESPONSES TO INDUCED HYPOTHERMIA IN DOG AND MAN

(L. C. Card No. Mic 58-7383)

Charles Albert Hamilton, M.D., Ph.D.
The University of Nebraska, 1958

Adviser: Robert Leslie Grissom, M.D.

Body consistency, thermoregulatory activity, and circulation are relatively constant after removal from the ice bath in the method employed. Therefore, it was theorized that rates of exchange of metabolites and heat between peripheral and central body sites are in accord with physical principles. Thus, the rate of drift of central body temperature should depend upon the surface to core temperature gradient, as for any passively cooling body. It might, therefore, be a logarithmic function and that fact should be helpful in predicting temperature drift. Prediction of downward drift of temperature after removal from the ice bath has been empiric. It usually has been estimated at one-half to two-thirds the number of degrees of lowering at the time the cooling agent is discontinued. This guess is not sufficiently accurate for maximum safety.

To better understand the cardiovascular dynamics underlying body heat exchange and circulatory failure of hypothermia, studies of peripheral circulation were undertaken in the dog. Hypothermia was induced by ice bath immersion in twelve dogs in which observations of rectal, esophageal, hind limb intramuscular temperatures, arterial pressure, heart rate, femoral artery flow, index of femoral resistance, and extremity radioactive sodium clearances were made. The femoral artery flows were made by the bubble flowmeter; flow in capillaries of leg muscle by radioactive sodium clearance. Responses to intra-arterial nylidrin hydrochloride (1 to 5 mg.) were observed in an additional seven dogs during either regional hypothermia by blood stream cooling or generalized hypothermia by immersion. Rapid rewarming was by immersion.

Average rectal temperature during hypothermia was 29.2°C. Femoral artery flow decreased 40 cc/min or to one-third of the pre-hypothermia control level, while the average index of femoral resistance rose from 2.4 pre-hypothermia to 7.8 during hypothermia. Each showed marked variability during the post-hypothermia phase. The radioactive sodium clearance constant (k) during the anesthetized pre-hypothermia phase averaged 0.108; during hypothermia 0.043; and post-hypothermia 0.068. Intra-arterial nylidrin hydrochloride caused marked increases of femoral artery flow (range-- 200 - 1,180%) and decreases of index of femoral resistance (range-- 50 - 90%).

From this study it is concluded: 1. Femoral artery and thigh muscle capillary flow are markedly depressed during immersion hypothermia. 2. They are variably decreased post-hypothermia. 3. Fluctuating increase of femoral resistance persists despite development of non-hemorrhagic post-hypothermia hypotension. 4. Thus, post-hypothermia circulatory failure is not primarily due to peripheral vasomotor paralysis.

Drift was analyzed in seven patients surface cooled for heart surgery; logarithmic plots for the rate of approach to surgical level of hypothermia were made for esophageal temperature recorded each five minutes. Subsequently drift was predicted mathematically with improved accuracy from these in eight patients before removal from the ice bath. Semi-logarithmic plots of temperature each minute during drift yielded straight lines of "best fit". This verified exponential central body temperature drop during drift.

From the results of this research it is feasible to improve the accuracy of prediction of the hypothermic surgical level of esophageal temperature. This is accomplished simply by extrapolating on a straight coordinate graph the line of esophageal temperature during the first fifteen minutes in the ice bath to find the temperature five minutes after the anticipated temperature of removal from the bath by the intercept with those two time lines. Further drift is an approximate 2° C. The curve of cooling during this equilibration is logarithmic. Use of equations for predetermination of this curve are feasible at the research desk.

Microfilm $2.65; Xerox $9.20. 202 pages.

HEALTH SCIENCES, PATHOLOGY

CHANGES IN THE SUBMAXILLARY GLAND OF THE RAT INDUCED BY LIGATION OF THE EXCRETORY DUCT

(L. C. Card No. Mic 59-1464)

Theodore Edward Bolden, Ph.D.
University of Illinois
Chicago Professional Colleges, 1958

Ligation of the excretory duct of exocrine glands is known to lead to atrophic changes resulting in selective reduction in parenchymal tissue and partial replacement by connective tissue. The present investigation was undertaken, to study the morphologic and biochemical changes which occur immediately after ligation. It was hoped that the study might help to clarify the mechanisms which lead to the atrophy of a glandular organ.

MATERIALS AND METHODS

Histological, histochemical and biochemical studies were made of the submaxillary glands of a total of 145 male Sprague-Dawley rats, ranging in age from 125 to 150 days.

Untreated rats, sham-operated animals, and the contralateral glands of animals with one ligated gland were used as controls. The animals were killed 1, 2, 3, 5, 7 and 9 days after the respective experimental procedure.

Some sections of each gland were stained with hematoxylin and eosin, Mayer's Mucicarmine, Mallory's aniline blue and thionine. Others were treated according to the Periodic acid-Schiff and Feulgen technique. An estimate was made of the proportion of surface areas in sections which were occupied by normal acini and by intralobular duct tissue. Frozen sections of patent and ligated glands were stained for neutral fat. Histochemical determinations of the sites of alkaline phosphatase activity were made.

Glands used for biochemical tests were frozen-dried. The biochemical tests included determinations of free aromatic amino acids, inorganic phosphorus, and the percentage of nitrogen in the dry weight, furthermore, assays of alkaline and acid phosphatase activity, and of proteolytic activity.

SUMMARY OF FINDINGS

(1) Sham-operated and contralateral glands of animals in which the duct of one gland was ligated showed slight degrees of transient edema, and infiltration of the capsule by neutrophils and decline of protease activity. Dry weight and alkaline phosphatase activity were slightly reduced even at 9 days.

(2) Ligated glands showed the following changes: The lumina of ducts and acini were enlarged from the first day on, and dilatation of the ducts was progressive. There was a progressive reduction in the number of intact acini. Compressed acini appeared increased in number in the first days, and decreased in later days. A small number of disintegrating, isolated or clumped acinar cells was observed. The intralobular ducts did not show signs of atrophy, but the secretion granules in their lining cells seemed to fade in later stages of the experiment and finally disappeared. Only a minute number of ductal cells were seen to disintegrate.

The stroma showed edema and in the first three days signs of acute inflammation, which was later followed by subacute inflammation and progressive fibrosis. During the stage of proliferation of connective tissue the number of mast cells increased. No sign of fatty degeneration was observed.

(3) Quantitative histological studies showed the intact gland to consist of approximately 60% acinar tissue, 25% intralobular duct tissue and 15% nonsecretory tissue. After 9 days ligation the gland had changed to a composition of 11% acinar, 40% intralobular duct tissue and 49% nonsecretory tissue. The increase in the number of mast cells was found to amount to a three-fold increase in density.

(4) The wet weight was increased in the first three days, declined progressively from the second day on, and reached values below controls from the fifth day on. The dry weight showed a slight elevation on the first day and values progressively below control on all later days. The proportion of solids in the total weight was below normal in all ligated glands from the first day on. However, the excess of fluid decreased on the 7th and 9th days.

(5) The composition of the ligated gland changed in the direction of a tendency to lowered nitrogen and lowered inorganic phosphorus, but a marked elevation of the free aromatic amino acids.

(6) Alkaline phosphatase activity showed a progressive decline on biochemical assay but reached its lowest point on the 7th postoperative day. Histochemical demonstration showed the enzyme localized in capillaries, basement membranes and myoepithelial cells of intact and compressed acini. Acid phosphatase showed erratic changes. Protease activity declined steeply and stabilized at around 15% of control values from the 5th day on.

(7) Changes in body weight were studied as a measure of the systemic effect of duct ligation. Body weight declined in most animals on the first postoperative day. On the subsequent days half of the animals showed slight gains or stationary weights, the other half showed loss of weight.

CONCLUSIONS

1. Following ligation of the excretory duct, the submaxillary gland of the rat undergoes rapid atrophy which in nine days leads to disappearance of 75% of the secretory parenchyma and to nearly the same stage as that observed following chronic ligation.

2. Analysis of the findings suggested that the rapidity of the atrophic process was due to the combined action of surgical trauma, pressure, and disuse. The following mechanism appeared to play a role. Pressure by accumulated saliva leads to direct injury of cells and to escape of saliva into interstitial spaces. The presence of injured cells and of saliva leads to inflammation, which in turn causes cell destruction. In a second phase, changes attributable to disuse are superimposed on the pressure changes.

3. Excess of fluid is due to retention of saliva, edema of inflammatory origin and retention of fluid due to raised osmotic pressure.

4. The acinar secreting cells are more vulnerable to pressure injury than the duct cells. The ductal secreting cells are more resistant to pressure and more vulnerable to disuse than the acinar cells.

5. The end stage of atrophy for acinar cells is cell death

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and disappearance for all but a minority. The end stage of atrophy for ductal secreting cells is the loss of secretory traits.

6. The mechanism by which the gland loses its parenchyma is likely to be predominantly the enzymatic autolysis of cells.

7. The increased number of mast cells during the stage of fibrosis is evidence supporting the theory that mast cells have a function in the production of connective tissue fibers.

Microfilm $2.00; Xerox $6.60. 139 pages.

HISTORY

HISTORY, GENERAL

HARDEMAN COUNTY: ITS ORIGIN AND ECONOMIC DEVELOPMENT

(L. C. Card No. Mic 59-1094)

Raymond McCoy Deming, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Dr. Jack Allen

The purpose of this study was: (1) to examine economic conditions of Hardeman County during the ante bellum and reconstruction periods, (2) to survey present economic conditions in the county, and (3) to analyze the conditions of yesteryear and today for evidence of trends or changes.

Findings of the Study

Many factors influenced the development of Hardeman County. Natural conditions are favorable to agriculture. There are few areas that could not be utilized for farming. The soils are easily tilled and fairly productive. The heavy rainfall and long summers are factors also that permit crop production.

During the ante bellum period the county became a slaveholding region and a producer of "King Cotton." There were, as a consequence, some large plantations, but the small farmer was also important.

The Civil War disrupted the economic activities of the county. Reconstruction was faced by a people that had lost about one-third of the adult males of the white population. Emancipation had given 7,880 former slaves their freedom. Thus an acute labor shortage resulted.

This seemingly disastrous condition was partly overcome by contract labor from the ranks of the new freedmen, the employment of all able-bodied whites and, to some extent, the use of orphan labor. The labor requirements could have been met rather easily if the landowner could have raised sufficient money to pay farm laborers. The inability to hire labor caused the landowner to turn to "sharecropping." This system took little in the form of capital but took much in the form of soil mining in return for a small cash gain. Thus in spite of the evils of tenancy it is no surprise that the sharecrop system became common in Hardeman County.

In the mid-twentieth century Hardeman County retains characteristics that tie her to the past. The plantation, a symbol of the ante bellum period, has not disappeared. Some of the modern plantations display characteristics of the plantations of the slavery period. Negroes, the source of labor in the ante bellum period, are also utilized in the labor force of today. Overseers, the directors of the plantations of the slavery era, are still common. The central barn that housed the work animals of yesterday has been replaced to a great extent by the central garage that houses the tractors and other machines. The control features of the slave plantation are copied, to a degree, through the use of a disbursing center for fuel and equipment. The village cluster of houses, so common to the slave plantation, exists on some present day plantations.

"King Cotton," the crop of the ante-bellum era, is still an important item. The production of cotton in 1950 amounted to approximately the same as in 1860, despite inroads made by crop acreage allotments, other crops and industry. Cotton is still the money crop and largest source of revenue for the people of the county.

Industrialization has made modest gains in the twentieth century. The only sizeable plants in the county are the International Shoe Company Tannery and the Tennessee Gas Transmission Pumping Station. Slow industrial growth is probably the principal factor causing the population in most agglomerated settlements to remain static or to decline. Bolivar and Hornsby are the only municipalities showing a population increase in recent years.

Hardeman County, like most of the South, has been an exporter of people. This tendency still exists. The ratio of whites to negroes has remained fairly constant. In 1830 the population was 31.37 per cent Negro, in 1950, 37.42 per cent Negro.

Hardeman County has been and remains an area best characterized as rural, agricultural and typical of the cotton South. Microfilm $3.65; Xerox $12.40. 284 pages.

HISTORY, MODERN

THE FREEDMEN'S BUREAU IN SOUTH CAROLINA, 1865-1872

(L. C. Card No. Mic 58-5108)

Martin Linton Abbott, Ph.D.
Emory University, 1954

As the instrument designed to implement Lincoln's Emancipation Proclamation, the Bureau of Refugees, Freedmen, and Abandoned Lands had before it in 1865 a staggering

task. To that agency, commonly known as the Freedmen's Bureau, was committed the economic, social, and legal well-being of the South's four million freedmen; upon its shoulders was placed the grave responsibility of making freedom meaningful for an entire people.

Organization of the Bureau in South Carolina began in June, 1865, with the appointment of Rufus Saxton as assistant commissioner for the state. From then until he was relieved from duty in the following January he labored, not always with success, to evolve an effective program for promoting the welfare of the blacks. A man of noble purpose and high resolve, he was at the same time an incurable idealist, tinged with not a little of the abolitionist's fervor. All too often he fell into the error of grasping the shadow while letting the reality elude him. His doctrinaire philosophy and his jaundiced view of the South hindered a speedy reconstruction of the state's society.

Saxton's successor, Robert K. Scott, from the time of his appointment in January, 1866, until his resignation in July, 1868, consistently displayed a realistic approach that contrasted sharply with his predecessor's abstract idealism. Scott frankly recognized that the Bureau was not destined to remain forever the freedman's guardian; his basic purpose, therefore, was to utilize the agency's power not only to elevate its charges to a position of responsible citizenship but also to establish a workable tolerance between white and black. In an effort to realize both goals he proved to be an administrator of rare integrity and exceptional merit.

Between the time of Scott's resignation and the disbandment of the Bureau, three other individuals served briefly as heads of the institution. But their tenures were too short or their resources too limited to permit any appreciable influence by them upon the outcome of the agency's undertaking.

Subordinate personnel of the Bureau were, on the whole, neither better nor worse than the assistant commissioners. Some were incompetent or dishonest, and a handful prostituted their offices to the partisan end of politics; but the great majority were honest and upright persons who strove to perform creditably an exacting work under trying conditions. Native white critics frequently hurled charges of malfeasance and corruption against the institution; but with a few notable exceptions, the allegations proved to be unsupported generalizations rather than specific indictments of particular individuals. Officers and agents, to be sure, never rendered a completely efficient service, but in most instances the fault was not principally theirs. The area of their jurisdiction, the number of freedmen they had to care for, and the complexity of their manifold responsibility, all proved too great to permit the careful attention demanded by the condition of the ex-slaves.

The effectual operation of the Bureau in South Carolina lasted from mid-1865 until the close of 1868, when all but a handful of officials were discharged. Thereafter, only the educational program and one or two minor undertakings continued. Educational activities lasted until July, 1870, and the minor labors until Congress formally disbanded the entire institution in June, 1872. In its attempt to develop the whole welfare of the freedmen, the Bureau in the state gave its principal attention to the questions of relief, land, labor contracts, education, and justice; with the notable exception of the effort to transform the Negroes into landed proprietors, it realized considerable success in its program.

Its relief work was designed originally as a mere expedient to alleviate the suffering growing out of the war. But because of successive crop failures in the state, distributions of food and clothing had to be continued on a semi-permanent basis. In all, between 1865 and 1868 about three million rations were issued, in addition to over three hundred thousand dollars worth of supplies loaned to planters on crop-lien security. Moreover, the Bureau offered free transportation to at least 5,000 persons, mostly ex-slaves seeking to return to their old homes, and medical care to some 175,000 individuals. Without such aid hundreds of Carolinians, both black and white, would have learned firsthand the meaning of privation and want.

At the same time, the Bureau endeavored to make a more enduring contribution by organizing a system of contract labor, under which the freedman would be not only acquainted with his new rights but also impressed with his enlarged obligations. Throughout the agency's life agents and officers supervised at least thirty thousand agreements between planters and laborers, sought to enforce them impartially on both parties, and, in an effort to see full justice done, arbitrated thousands of disputes growing out of them.

In the work of educating the freedmen the Bureau's role was indirect but nonetheless vital. It did not attempt to recruit teachers nor did it pay their salaries; these were the functions of the Northern benevolent societies. But it did investigate school needs, keep the progress of education before the nation, co-ordinate the work of the various private groups, and devote a sizeable portion of its funds to the "repair and rental" of buildings--a phrase construed as liberally as possible to render the greatest aid. By such labors it helped benevolent societies between 1865 and 1870 to offer schooling to a yearly average of 10,000 students under 175 teachers in 85 schools.

Finally, the Bureau undertook the task of regularizing the marital status of the ex-slaves, urging the virtues of systematic savings upon them, and attempting to organize temperance leagues among them. While less spectacular than the major programs, all these were undertaken to facilitate better citizenship on the part of the Negro; all were designed to contribute to the sum total of his freedom.

Most of the gains promoted by the Bureau came in the face of unusual difficulty. For one thing, the institution throughout its existence was confronted by a hostile white opinion; for another, the financial resources of the agency were never such that it could be amply staffed, so that even at the peak of strength, personnel remained hopelessly inadequate. Finally, agents and officers necessarily had to rely upon the military as the means for enforcing their orders; and in view of the fact that Federal troop commanders in the state were seldom more than lukewarm toward the Bureau, the arrangement constituted a serious handicap.

In part because of these difficulties, in part because of its own incapacity, the Bureau failed in some respects to accomplish its objective. Most notably, it did not succeed in leaving behind a more workable tolerance between the ex-slaves and their former masters. By the arbitrary treatment it occasionally gave whites, and the excessive stress it sometimes placed upon the welfare of the blacks, it heightened the racial antagonism growing out of war and Reconstruction.

In sum, the Bureau's success in South Carolina was qualified. It failed to fulfill the dream of its sponsors that

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it would transform the recent slaves into responsible, educated, landowning citizens; but it had eased enormously their transition from bondage to freedom. Remembering that what it did accomplish was achieved in spite of serious handicaps, the wonder is not that it did so little but that it did so much.

Microfilm $3.40; Xerox $11.60. 261 pages.

THE SAGA OF AN IRISH IMMIGRANT FAMILY: THE DESCENDANTS OF JOHN MULLANPHY

(L. C. Card No. Mic 59-891)

Alice Lida Cochran, Ph.D.
St. Louis University, 1958

Immigration, in general, and its impact on the development of this nation have received considerable attention from historians. There are also specific studies of national immigrant groups in the United States--Hanna and Ford for the Scotch-Irish and Wittke for the Irish, to recall several of the better known--but there have been very few studies which take the next step and trace the story of an individual immigrant and his descendants. Not only does this study seek to do this, but it further follows said immigrant to the frontier. Hence, two purposes are served: First, to sketch the saga of an individual immigrant family, and secondly, to show the special opportunity which opened to men of energy and enterprise in a society in the process of formation.

The immigrant in question is John Mullanphy who arrived in the United States from Ireland in 1792 and who subsequently made his way westward to the frontier village of Saint Louis a dozen years later. He was the "progenitor" of a "clan" which played a large part in helping Saint Louis to develop into a great American city, and was so successful in his business ventures that his is a real "American success story."

The fact that John Mullanphy was of Irish birth was of little or no importance on the frontier. He came to a relatively new settlement in the process of formation, to a community which had not as yet established definite patterns into which newcomers were supposed to fit. In this unexploited country John Mullanphy's antecedents, national and religious, made little difference.

To appreciate the contrast between an Irishman's arrival on the frontier and his arrival in a more static society in this period, it is helpful to consider such a settled community as Boston, for example. The Irish were not always too welcome an ingredient in the American melting pot. By early nineteenth century, New England had developed a self-contained and fairly homogeneous population which did not welcome the influx of "improvident" Irishmen who arrived in increasing numbers as the years advanced on to mid-nineteenth century. In fact, the term, "Boston Irish," still carries a stigma even down to our own day.

As for John Mullanphy and his connection with Saint Louis, the fact that he was Irish was not the significant point; he could have been German or Scandinavian for all the difference it made in this instance. The vital factor is the man and the frontier and the opportunities a still fluid milieu afforded one who was willing to take full advantage of them. Such is the story of an American family into its seventh generation in a country and in a community which the "Mullanphys" helped to develop.

Microfilm $3.55; Xerox $12.00. 275 pages.

THE PRESBYTERIAN CHURCH IN THE SOUTH ATLANTIC STATES, 1801-1861

(L. C. Card No. Mic 58-5132)

Margaret Burr DesChamps, Ph.D.
Emory University, 1952

Through the everyday lives of its ministers and members, and through its courts, press and educational institutions, the Presbyterian Church seems to have touched every area of Southern life between 1801 and 1861. While the church never won a following such as the Methodist and Baptist denominations enjoyed, its influence exceeded the size of its membership and enabled it to stand with them as one of the three great evangelical churches of the Old South. The story of its contribution to the expanding cotton kingdom has already been told by Professor Walter B. Posey in a manuscript soon to be published under the title, The Presbyterian Church in the Old Southwest. The present study is designed to be a social history of the Presbyterian Church in the South Atlantic states--Virginia, the Carolinas, Georgia, and Florida--from the time of the Great Revival of 1801 to the disruption of its ecclesiastical organization by the Civil War. An attempt is made to analyze the attitudes of the main body of Presbyterians, those belonging to the Presbyterian Church in the United States of America, on such important questions as morals, education, westward migration, slavery, and secession. In discussing these issues, an effort has been made to show how they affected the church and the ways in which Presbyterians attempted to meet them.

The study is based largely on unpublished minutes of church courts, letters and diaries of Presbyterian families, and ministerial correspondence. The Historical Foundation of the Presbyterian and Reformed Churches in Montreat, North Carolina, has an extensive collection of documents relating to the work of the church in Virginia, the Carolinas, Georgia, and Florida. Additional records of churches in Virginia are located in the library of Union Theological Seminary and the Virginia State Library in Richmond. The South Caroliniana Library of the University of South Carolina has copies of records of many churches in South Carolina. Notable collections of family papers and ministerial correspondence are found at the Presbyterian Historical Society in Philadelphia, the Historical Foundation in Montreat, the Library of Congress, Princeton University, the Historical Society of Pennsylvania, the University of North Carolina, Duke University, the North Carolina Department of Archives and History, the University of South Carolina, and Union Theological Seminary. Excellent files of church periodicals are located at Columbia Theological Seminary, Decatur, Georgia, the Historical Foundation in Montreat, and the Presbyterian Historical Society in Philadelphia.

Throughout the ante bellum period all evangelical churches served as conservative forces in the South Atlantic states, but none to a greater degree than the

Presbyterian. Since its doctrine and program had limited appeal to the masses, the church strove above all else to preserve what it believed to be the historic Calvinistic faith, to educate its members in this belief, and to bring families of Presbyterian background into its fold. Never popular in the tidewater area, Presbyterianism found its strength among the Scotch-Irish who settled in the middle and back country and shared a common pattern of life and thought. The people who joined the church were for the most part substantial yeomen and planters. As these members opposed changes that might endanger their positions, they sought to maintain the status quo in all matters, political, social, and religious. They selected the older and more respectable men to serve during their lifetimes as ruling elders of their congregations. These officers chose ministers and paid their salaries, and sent representatives to higher church courts; hence, they were the real power in the Presbyterian Church and served as a constant check against innovation. Because of the location of churches, the character of membership, and the manner of government, homogenity and conservativeness characterized the denomination and can be seen in every sphere of its activity.

An analysis of the attitudes taken by the church toward ecclesiastical issues reveals that Presbyterians in the South Atlantic states tended to cling to old and accepted ways. Although they somewhat accidentally inaugurated the Great Revival and for several years participated in it, they quickly came to denounce the physical exercises and excesses which accompanied the revival. They frequently held camp meetings, but they continued to discourage any unusual display of the emotions. Members were to be brought into the church through the time-honored method of religious training in the family. In its relations with other denominations the church generally sought to avoid strife and controversy, rather than to follow the policy of aggression and proselyting begun by Methodists and Baptists to gain members. While other denominations moved in the direction of separate churches for Negroes, the Presbyterians continued to include them in the same church with white members. When the New School-Old School controversy split the denomination, the South Atlantic churches predominantly supported the Old School which was thought to be more in line with Presbyterian tradition. Regardless of changes in the religious scene in general or the Presbyterian Church in particular, members in the South Atlantic states preferred that Presbyterianism remain what it had always been.

The Presbyterian Church through its zeal for education was a powerful cultural force in Southern life, but its intellectual vistas were narrow. It attempted to teach its members to defend historic Calvinism against modern error by establishing congregational libraries, religious periodicals, and schools. Underlying Presbyterian support of numerous schools, colleges, and seminaries was the desire to train ministers at home instead of in Northern colleges where they might adopt attitudes hostile to the Southern social system and Old School theology. In their efforts to control state universities and to suppress error and heresy, Presbyterians unrelentingly fought free thought and liberalism. Yet, in spite of its limited aim and its intolerance of free inquiry in the intellectual realm, no other denomination made as great a contribution to education in the South.

Neither the attitude of the church on moral issues nor the method of bringing members to conform to its standards changed materially during the ante bellum period. Beliefs about sin, as well as punishments meted out by sessions for disobeyance of moral law, continued with no noticeable modification. Elders kept strict watch over business transactions of individual members, their observance of the ten commandments, and their participation in the "vain amusements of the world." Communicants were expected to circumscribe their recreations and amusements. To encourage them to center their social life about the program of the church, congregations sponsored benevolent societies which provided occasions for friends and neighbors to meet together.

On public issues the stand taken by the church was consistently conservative. Until the common fight to curb the economic, political, and ecclesiastical power of the North cemented bonds between Southeast and Southwest, Presbyterians in the South Atlantic states fought the westward movement which disrupted life in the older communities. Because a large percentage of church members were slaveholders, they refused to let their Northern brethren make a real moral issue of slavery and relegated it to the realm of civil institutions. The power of the laity is nowhere more in evidence than in the stifling of antislavery sentiment among the clergy. By 1837 slavery was a closed issue in the Presbyterian Church in the South Atlantic states, and by 1850 leading Presbyterian ministers were among its ablest defenders.

Since they believed slavery and other financial investments safer in the union than out of it, church members were the firm friends of the federal government. Their ministers, deploring political excitement which jeopardized interest in spiritual matters, and doubtless influenced by the opinions of their congregations, became ardent champions of the union. However, in the fall of 1860 both laymen and ministers in the lower South were won to secession. In the eyes of the ministry the election of Abraham Lincoln to the presidency imperiled the cause of Christianity. When hostilities appeared inevitable, ministers in the upper South reluctantly joined the secession forces. By the end of 1861 congregations found themselves not only living under a new political organization, but also members of the "Presbyterian Church in the Confederate States of America."

The Presbyterians of the ante bellum period strengthened and articulated conservatism in the South Atlantic states. Always strict about morals, they came to uphold the status quo in other realms during the 1830's. Cotton economy and the abolitionist crusade led them to a justification of slavery; the New School-Old School controversy allied them with conservative theologians; the nullification crisis augmented their attachment to the union; and westward migration and sectionalism increased their defense of life in Southeastern communities. The importance of the position of Presbyterians on secular and ecclesiastical issues lies both in its influence on their contemporaries and in its effect on their descendants. A clannish people, the Presbyterians passed on to future generations the tradition of a conservative attitude toward such matters as morals, race, and doctrine, but a high regard for piety, integrity, and learning.

Microfilm $3.15; Xerox $10.80. 241 pages.

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SHÁH TAHMÁSB AND THE ÚZBEKS (THE DUEL FOR KHURÁSÁN WITH 'UBAYD KHÁN: 930-946/1524-1540)

(L. C. Card No. Mic 58-7838)

Martin B. Dickson, Ph.D.
Princeton University, 1958

Section I: The Safavids and the Úzbeks at Sháh Tahmásb's Accession in 930/1524 (pp.5-50): The necessary background is provided here: On the Ṣafavid side, the basic terms Ṣafaví, Shí'eh, Qizilbásh, úymáq and Tájík are defined with special emphasis on the úymáq system and the relationship of Dynasty and Qizilbásh--particularly in Khurásán. In turning to the Úzbeks, the focus is on the political system of "neo-eponymous appanage-states", with particular reference to the functions of the Dynastic House (Abú'l-Khayrid and Yádgárid), the "Grand Khán", the rule by "peers" and the seniority factor; theory and practice are examined as are the elements leading to a more conventional type of dynastic system. Safavid-Úzbek relations are then outlined for the previous period of Sháh Ismá'íl and Shíbání Khán which culminated in the Safavid occupation of Khurásán. The Sunní-Shí'eh issue is introduced as the role of the Tímúrid-Mughals.

Section II: The Duel for Khurásán: Chapter 1. Period of the First Úzbek Invasion:930-2/1524-6 (pp.51-84): The first Úzbek attempt on Harát is described as an "adventure" and as differing from the subsequent invasions in which 'Ubayd Khán was aiming at permanent conquest. The inability of the Qizilbásh to cope with the foreign danger is seen in the troubled accession of the Sháh and the First Ustájlú War in which the Rúmlú, Dív Sulṭán subverted an army intended for Khurásán, and used it to seize control of the regency despite the armed opposition of the Ustájlú. This úymáq seizure of control at Court is parallel with the Shámlú seizure of control in Khurásán and the elimination of the Tájík-bureaucratic opposition there. The Úzbek conquest of eastern Khurásán (Balkh) from the Mughals at this time is also noted.

Chapter 2: Period of the Second Úzbek Invasion:933-5/1526-8(pp.85-141): The lack of a "national" (i.e. Ṣafavid-Qizilbásh) policy is seen in the Second Ustájlú War which encouraged 'Ubayd Khán to attempt the conquest of Khurásán. He first took the area from Mashhad to Astarábád and then held Harát under a seven month siege of attrition. The Qizilbásh atrocities on the Harátís are described and seen to differ little from the similar acts of the Úzbeks. The Court was finally able to organize its first liberation army after the Úzbeks had raided Fírúzkúh. The result was the Battle of Jám, the one occasion when Sháh faced Khán in open battle and in which both sides were totally committed. The Qizilbásh victory was due to the use of "modernized" Ottoman methods of warfare involving the use of heavy firepower unavailable to the Úzbeks. The Qizilbásh did not however follow through on their victory but turned westward instead to suppress a revolt in Baghdád in which the Ottomans were peripherally involved. The real victory of Jám lay in the fact that the Úzbeks could not again be united to oppose the Qizilbásh in the field.

Chapter 3: Period of the Third Úzbek Invasion:935-7/1529-31 (pp.142-196). With the Qizilbásh army in the west, and the sabotage due to factionalism at Court, 'Ubayd easily took Mashhad and Harát by negotiated surrender. The Alleged sectarian atrocities are refuted and it is seen that wealthy Sunní and Shí'eh suffered alike despite the sectarian pretext. (The example of the execution of Hilálí is cited.) The new liberation army (a reflection of the Sháh's growing political stature) forced 'Ubayd to abandon Harát; his efforts to raise a new all-Úzbek army were vetoed by his "peers". This is the time of the exchange of correspondence between Sháh and Khán, the propagandistic content of which is analyzed. The Úzbek-Mughal War is then cited as an example of the non-cohesiveness of Úzbek policy; the Qizilbásh equivalent is noted, i.e. the suspicious acts of the Shámlú which drew the royal army from Khurásán to Iṣfahán.

Chapter 4: Period of the Fourth Úzbek Invasion:937-41/1531-4 (pp.197-252). On the domestic scene, the Qizilbásh were effected by the "Takkalú Disaster" and the new Shámlú hegemony at Court, and the Úzbeks by the election of Abú Sa'íd as Grand Khán. 'Ubayd then launched his new invasion and again took the area from Mashhad to Astarábád; however Harát resisted for a year and a half (the "long siege") during which time the Qizilbásh garrison was again guilty of atrocities on the civilians. The Court, after two military seasons on the western front against an Ottoman threat, finally launched a new liberation drive at the approach of which 'Ubayd again fled, for he was faced with the disorders following Abú Sa'íd's death and the difficulties of securing his election as Grand Khán. The Sháh, in Harát, planned an offensive against the Úzbeks but this had to be abandoned at the surprise Ottoman invasion.

Chapter 5: The Ottoman Invasion and the "Grand Sedition": 940-2/1535-6 (pp.253-295). Úzbek-Ottoman relations are briefly traced and the possibility of joint anti-Qizilbásh action discussed. More than the military events, the emphasis is on the "Grand Sedition" of the úymáq who with Ottoman aid and possible Úzbek collusion attempted to unseat the Sháh in favor of the royal brother, Sám Mírzá, the rebellious governor of Khurásán. Inter-úymáq factionalism and its background are discussed and the Sedition given unity by connecting the Takkalú aspect in the west with the Shámlú aspect in Khurásán. The Sháh's victory on both the foreign and domestic fronts is seen to have restored Sháh Ismá'íl's dynasty-úymáq balance which resulted in the emergence of the Sháh as de facto ruler and the possibility of a "national" policy against the Úzbek attempts to annex Khurásán.

Chapter 6: Period of the Fifth and Final Úzbek Invasion: 941-4/1535-8 (pp.296-366). The situation in Khurásán is traced through Qizilbásh localism and atrocities, the anti-Qizilbásh "Harát Revolution" and the second Úzbek occupation. 'Ubayd's evacuation and the mutiny raised against him are cited as evidence for a decline in his power and prestige. The final liberation of Khurásán is then described, which included an advance into Turkmenistan against the Khwárizmian Úzbeks and the temporary conquest of Qandahár from the Mughals. The victory is seen as stemming from the new Qizilbásh unity arising after the suppression of the Grand Sedition, as opposed to 'Ubayd's loss of prestige among the Úzbeks and the resultant eclipse of his vision of a unified and expansionist Úzbek state.

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Chapter 7: Concluding Events:944-6/1538-40 (pp.367-391). The revolts in Kháf and Astarábád and their Úzbek connections are then considered. This entails a discussion of the mixed Turkí-Hijrí dating system and the "chronological tangle" in the sources. The death of 'Ubayd Khán after the fiasco of his Khwárizmian invasion and a brief notice of subsequent Úzbek relations with Sháh Ṭahmásb conclude the study.

Appendix I(pp.I-XLIV) is devoted to a special study of the Khwárizmian Úzbeks during this period in which the emphasis is on political theory and the relations with the Qizilbásh. Abú'l-Ghází's Shajareh-yi Turk has been collated with the Ṣafavid sources for these purposes.

Appendix II(pp.XLV-LXIV) is devoted to the sources, which are primary and near-contemporary. Ṣafavid and Úzbek manuscripts and printed histories as well as standard Ottoman and Mughal sources have been consulted. Appendix III is a table of the Turkí-Hijrí correspondences and includes a list of the qishláqs made during this period.

Microfilm $6.00; Xerox $21.20. 471 pages.

THE ORIGIN AND GROWTH OF THE ETHICAL CULTURE MOVEMENT IN THE UNITED STATES

(L. C. Card No. Mic 59-897)

James Richard Hartnett, Ph.D.
St. Louis University, 1958

During the latter half of the nineteenth century a philosophy of ethics known as Ethical Culture was developed in the United States. Its originator, Felix Adler, had been trained to be a rabbi, but his studies in Germany led him away from Judaism and to the conviction that the traditional orthodox religions, especially Judaism and Christianity, were no longer capable of directing man's public life in the modern world.

Adler felt that evolutionary theories, the Higher Criticism of the Scriptures, and such modern sciences as anthropology, psychology and sociology had destroyed the basis of belief in the traditional religions. His new "religion" did not concern itself with ultimate questions such as the origin of the world, the existence of God or the destiny of man. It was a theory of moral perfection based solely on man's natural sense of duty. Adler was influenced by the philosophy of Immanuel Kant, and like Kant, stressed the moral worth of the individual person, but unlike Kant proposed the concept of a spiritual universe to replace the traditional concept of God.

According to his ethical ideal, Adler reinterpreted the function of the family, the school, the state and the church. In 1876 he established the first Ethical Culture Society in New York City. Other men, who accepted and developed Adler's general position as to the supremacy of morality, then became the leaders of Ethical Societies in other cities.

Ethical Societies function as churches for the "unchurched", that is, for those who find other religions unsatisfactory. They conduct Sunday services and Sunday schools, promote the study of ethical theories and their application to social problems, and engage in a variety of social works. The New York Ethical Society operates two elementary schools and one high school. Some of the social works initiated by the Ethical Societies are carried on today by other organizations.

Ethical Culture Societies have no official philosophy or statement of beliefs. Their moral teachings are drawn from many different sources, christian as well as non-christian. Members of these Societies are united solely by the belief that deed is more important than creed, and are free to hold whatever they wish on other matters.

The growth of the Ethical Culture Movement in the past eighty years of its existence has been neither steady nor rapid. In the United States the oldest and largest Ethical Societies are in New York City, Chicago, Philadelphia, Saint Louis and Brooklyn. In addition to these, there are eight smaller Societies and ten Fellowship Groups. All of them are members of the American Ethical Union. In 1956 these Societies had a total of five thousand four hundred and forty-two members, located mostly in New York and vicinity.

The Ethical Culture Movement is unique as a modern attempt to improve morality without recourse to theological doctrines, and it seeks acceptance as a universal, democratic, "religion."

Microfilm $3.70; Xerox $12.60. 288 pages.

THE FOREIGN POLICY OF LOUIS BARTHOU, 1933-1934

(L. C. Card No. Mic 58-5951)

John Rison Jones, Jr., Ph.D.
The University of North Carolina, 1958

Supervisor: Carl Hamilton Pegg

This dissertation is an examination of Louis Barthou's foreign policy from February 9 to October 9, 1934. It attempts to analyze five major aspects of that policy: disarmament; the formation of an Eastern Locarno system of mutual assistance; the entrance of Soviet Russia into the League of Nations; Franco-German relations in the Saar; and France's relations with Austria, Italy, and Yugoslavia.

The rise of the Nazis to power, the withdrawal of the Reich from the League of Nations and from the Disarmament Conference, the ominous foreign policy of Hitler, and the Nazi-Polish Pact combined to produce uneasiness not only in France but throughout Europe. Barthou's policy was conditioned by these factors. Germany's withdrawal from the Disarmament Conference and the subsequent negotiations aimed at her return to Geneva and a disarmament convention based on the opposing concepts of "equality of rights" for Germany and adequate "security" for France necessarily became the focal points for French policy.

Barthou refused to negotiate disarmament without a clarification of probationary periods, computation of personnel and armaments, inspection, and German paramilitary formations. When, however, Britain and Italy consented to substantial rearmament on German terms, Barthou faced two alternatives: to secure effective guarantees of execution from Hitler, or, to permit uncontrolled rearmament. The publication of the German Budget for

1934-1935 containing large military appropriations and the adamant insistence of the French General Staff on absolute British commitments convinced Barthou that German rearmament could not be prevented by a disarmament convention or by Anglo-French cooperation. On April 17 he issued his ultimatum: French security took precedence over Germany's "equality of rights." During the May-June disarmament debates, Barthou won this point. France, henceforth, placed her destiny on a military basis, fortified by the French alliance system.

Barthou undertook to reinvigorate these alliances by visits to Poland and Czechoslovakia in April and to Belgrade and Bucharest in June. These visits and the abandonment of disarmament made alliance with an equally anxious Soviet Russia eminently practical. Barthou sought and found with Maxim Litvinoff a formula which associated Russia with security within the League. This was the Eastern Locarno. Barthou reasoned that guarantees of both German frontiers would remove Germany's feeling of being threatened, deprive Hitler of an excuse to rearm, and avert the danger of war by a new security concept. In July the plan won unexpected British and Italian approval, but in September met a German refusal and Polish objections which permitted France eventually to seek a mutual assistance pact with Russia.

The major outcome of the Eastern Locarno negotiations was the entrance of Russia into the League in mid-September, with Barthou as sponsor, and the pinning down of Russia to the support of peace and the rejection of territorial revision. Russia thus joined the forces satisfied with the status quo and Barthou won a major diplomatic victory.

Convinced that Austrian independence was the key to Italo-Yugoslavian relations, Barthou attempted to substitute for the vague Three-Power Declaration of February, 1934, a new international guarantee under the auspices of the League of Nations. The plan, however, was immediately unsuccessful, for Britain refused further continental commitments. Nevertheless, after the failure of the Anschluss in 1934, Barthou reinforced with a further statement the earlier Anglo-French-Italian decision to maintain Austrian integrity. The assassination of Barthou and Alexander of Yugoslavia on October 9 ended the French attempt to reconcile the divergent policies of Belgrade and Rome.

Barthou's policy marked an abrupt transition from appeasement and conciliation to stern intransigeance. In contrast to the policies of his predecessor, Paul-Boncour, and his successor, Pierre Laval, Louis Barthou attempted to infuse spirit into Eastern Europe, to induce Britain to abandon her insular aloofness for continental commitments, and to force Europe boldly to face Nazi Germany. His was the first, and until Winston Churchill, the last vigorous opposition to the growing menace beyond the Rhine.

Microfilm $7.40; Xerox $25.40. 582 pages.

THE FIRST GIRONDIN MINISTRY, MARCH-JUNE 1792: A REVOLUTIONARY EXPERIMENT

(L. C. Card No. Mic 58-5158)

Charles Alfred LeGuin, Ph.D.
Emory University, 1956

The first Girondin Ministry, March-June 1792, was the unique Revolutionary experiment in something like the cabinet system of government. The Royal Councils of the Old Regime were created by the king and solely responsible to him, since there was no legislative body to exert claims on the ministers. There was no chance to establish a responsible cabinet system of government in a political situation such as the pre-Revolutionary one.

The changes in the political situation wrought by the Revolution were first embodied in the Constitution of 1791. The position of the ministry as established by this document was at once so ambiguous and so restricted as virtually to nullify the ministry as a useful branch of government. The Constitution of 1791 fixed the number of ministerial departments and carefully regulated the functions and duties of each; it allowed the king to name his ministers and made them responsible to him, but prohibited his naming members of the legislative body to ministerial office; and even though this document denied ministers free access to the halls of the legislative body, it held them in strictest accountability to the Assembly. The position and duties of the ministers were so hampered under this constitution as to render the ministerial office all but powerless. That a significant development in ministerial government could take place under such circumstances is perhaps surprising; that such a development did take place with the first Girondin Ministry makes its study important.

The Girondin Ministry was actually the second ministry to be formed after the Constitution went into effect on October 1, 1791. It was preceded by a Feuillant Ministry, whose history was a stormy one. The Feuillant Ministry occupied the same unlikely constitutional position as the subsequent Girondin Ministry, and thus had the same chance to experiment with responsible cabinet government. It made, however, no attempt to do so, and its history illustrated the weakness of the ministerial position as established by the Constitution of 1791 rather than the potentialities of responsible cabinet government. The Feuillants fell not because they lacked the favor of Louis XVI or a sense of responsibility to him, but because they had no sense of common purpose and action, no appreciation of ministerial unity, and little feeling of responsibility to the Assembly, in which, it must be admitted, their party almost immediately lost control.

The ostensible cause of the Feuillant government's fall was the question of war with Austria, and the first Girondin Ministry was formed as a war government, benefiting from the failure of the Feuillants to capitalize on a popular cause. The members of the first Girondin government were Dumouriez (Foreign Affairs), Lacoste (Navy and Colonies), Duranthon (Justice), Degrave and then Servan (War), Clavière (Public Contributions and Revenues), and Roland (Interior). It was the last three of these ministers who gave the ministry its true Girondin cast, for in the course of events they alone proved themselves devoted to the party's cause.

It was not its success as a war ministry that made the first Girondin government famous; indeed as a war ministry it left something to be desired. Its importance, and the significant difference that sets it apart from Revolutionary ministries that preceded or followed it, lie in the fact that the Girondins, experimentally but consciously, sought to evolve a workable, responsible cabinet system of government from their unpromising constitutional position. Several advantages aided the Girondins with their experiment. Not the least of these was the ministers' recognition of and adherence to some of the concepts essential to the cabinet

system. They were particularly aware, for example, of the need for ministerial solidarity and for harmonious relations with the Assembly. The Girondin ministers were fortunate in that their partisans in the Assembly managed to dominate that body, and, despite the fact that the Girondin deputies appreciated less than the ministers the importance of coöperation between the ministry and the legislative body, they could hope for positive action in conjunction with the Assembly. The ministers were less understanding of their responsibilities to the king and less careful of their relations with him.

Riding to power as a war government on a wave of popular support, united in purpose, having an advanced conception of the ministerial office and its duties, and resting upon the strength of an Assembly dominated by Girondin leaders who were largely responsible for the selection of the members of the ministry, the first Girondin government hoped for a successful future. It sought to embark upon several impressive programs, and due to the pressures of war it had to face problems that would put it to test.

The Girondin ministers, especially the Minister of the Interior, had special plans which they wished to effect: Roland wanted to carry out agrarian reforms so as to place land in the hands of the small proprietor; he and Duranthon wished to see the Civil Code completed; he and Condorcet envisioned a remarkable system of education; he hoped to establish religious peace; and he and Clavière both had ideas for putting France on a firm financial basis. In addition to long-range plans the ministers had to cope with some major problems, such as those of food supplies and finances. Both of these were problems of major proportions before the Girondin Ministry was formed; they were intensified by the war, which began within a month after the ministers took office and which was itself a pressing problem for the ministry, since it proved, at first, an inauspicious enterprise.

In acting upon the ministers' plans for financial, educational, agrarian, or religious reform, or in solving the desperate problems of food shortages and financial confusion, the Girondin Ministry would seem a fairly complete failure. In no case was a plan or program presented by a minister completely accepted and acted upon. Much of the blame for this lack of positive achievement can be laid on the war. The question of war so occupied attention and energies that little or no time could be given to plans for educational systems or for agrarian reform. Still more unfortunate for the Girondin government and more detrimental to its plans and programs was the effect of the failure of the war effort. Failure in a cause so intimately connected with the Girondins and their government naturally reflected unfavorably upon both party and government. Not only did they lose popularity, but they also lost certain and steady control in the Assembly; they were able to summon support for emergency measures designed to remedy the disastrous military situation, but beyond this, political dominance began to slip from their hands. In general, opposition gathered under the leadership of Robespierre; it became vocal and powerful, having an effective rallying point in the humiliation suffered by the French armies at the front. Equally detrimental to the Girondin cause was the effect of war and failure on the ministry itself: it now split into two equal and mutually hostile groups, the true Girondins, Roland, Clavière, and Servan, in opposition to the political adventurer Dumouriez and his supporters Duranthon and Lacoste.

The denouement of the Girondin ministerial experiment came as a result of three emergency decrees, that of May 27, 1792, subjecting non-juring priests to deportation; that of May 29, suppressing the King's Guard; and that of June 8, demanding the formation of a camp of 20,000 fédérés. These decrees had the support of Roland, Clavière, and Servan, and of the Girondin leaders of the Assembly, who were able to arouse enough support in the Assembly to see these extraordinary decrees passed. Among the ministers, however, the decrees caused an irremediable schism. Dumouriez, supported by Duranthon and Lacoste, showed his lack of party loyalty by siding with the king, who would accept only the decree abolishing his Guards. When Roland sought to lecture and threaten Louis with his letter of June 10, the situation was ripe for the king to dismiss a government objectionable to him. The Girondin ministerial experiment came to an inglorious end with the dismissal of Roland, Servan, and Clavière on June 13.

There were evidently several causes for the failure of this attempt at cabinet government. The Ultimate factor was, of course, the attitude of Louis XVI, who disapproved of the Girondin Ministry from the start; but his attitude was in part simply a response to that of the ministers, who were fatally negligent of their responsibility to the king. They were more clearly aware of the importance of keeping up a well-defined, coöperative relationship with their partisan support in the Assembly; but here, despite all efforts they could make, their own party failed them. Letting itself be divided into two factions, Robespierrist and Girondin, the party lost its secure dominance of the Assembly. This split was an event entirely beyond the ministers' control, as were certain circumstances which furthered it: the obsessive fear of undue ministerial influence held by many deputies, the predominance of the question of war, and the growth of a powerful opposition because of failure in war.

Despite the obvious fact that in practical achievements the first Girondin Ministry had a negative score, that its concepts of responsible cabinet government were not fully developed, and that the experiment failed, the attempt was unique and significant. Never before or afterwards during the Revolutionary period was an attempt made to create such a system of government, nor was the situation ever such that an attempt could be made. It is perhaps one of the tragedies of the French Revolution that the first Girondin Ministry did not succeed.

Microfilm $2.80; Xerox $9.60. 215 pages.

THE HISTORY OF THE BUILDING OF THE GOLDEN GATE BRIDGE

(L. C. Card No. Mic 59-1444)

Richard Thomas Loomis, Ph.D.
Stanford University, 1959

Supervisor: G. H. Knoles

This study covers the period from 1916 to 1958 and provides the first serious history of the Golden Gate Bridge written from original materials. Two accounts, E. Cromwell Mensch, The Golden Gate Bridge (San Francisco, 1935) and Joseph B. Strauss, The Golden Gate Bridge (San Francisco, 1937), provide excellent detailed technical

descriptions of the span; neither of these studies, however, discusses the bridge in its local economic and political setting.

The Francis V. Keesling Papers in the Borel Collection at Stanford University afforded the most fruitful source of information. Keesling, a director of the Golden Gate Bridge and Highway District from 1929 to 1936 and chairman of the influential building committee, kept copies of the minutes of the board of directors and board of engineers. In his correspondence file were letters pertaining to bridge politics and the district's successive attempts to secure federal financial aid from the Reconstruction Finance Corporation, Public Works Administration, and Work Projects Administration. Keesling's 200-page personal diary gave an additional account of the bridge district's struggle against economic adversity and political intrigue.

Valuable primary material describing the efforts of the San Francisco city government to promote the building of a crossing was found in the files of the San Francisco Board of Supervisors, the San Francisco city engineer, and the California State Public Utilities Commission. Stories related to the growth of the bridge project over the years were taken from the metropolitan newspapers in San Francisco and from selected journals in Marin, Sonoma, and Mendocino counties. The decisions of the California State Supreme Court provided background to the legal struggle between the major bridge opponents (the Southern Pacific Railroad and the ferry companies) and the bridge district.

Personal interviews, biographies, memoirs, special studies, and magazine articles comprised the remaining sources of information investigated by the author.

This work discusses several economic and political effects of the Golden Gate project. As an engineering feat, the 4,200-foot Golden Gate suspension span stands as one of the major triumphs of the twentieth century. As a depression antidote, the $35,000,000 structure had a very salutary effect on the economy of San Francisco and of certain steel centers in Pennsylvania and New Jersey. The financing of the bridge bonds presented difficult problems, solutions to which were made simpler by the assistance of the unorthodox and courageous A. P. Giannini and the Bank of America.

Politically, the Golden Gate Bridge and Highway District was unique, since it was the only bridge district formed under the provisions of the 1923 enabling act. The extended litigation (1926-1933) challenging the constitutionality of the bridge district forms an important segment of this work. Moreover, attention is given to the unsuccessful attempts in the state legislature to bring the bridge under state control.

The most explosive political issue during bridge construction concerned a former San Francisco County sheriff, Thomas Finn. The central issue was Finn's alleged attempts to dominate bridge policies by hand-picking the San Francisco candidates to the bridge directorate. By the time the bridge was completed in 1937, many of San Francisco's leading political and civic leaders had been drawn into the controversy.

The completion of the bridge ushered in a new era in motoring for San Francisco Bay residents. The span made possible the free flow of traffic between San Francisco and the northern counties, giving added impetus to the economic expansion of the area and bringing the North Bay counties more thoroughly into the orbit of San Francisco's business and cultural life. Microfilm $3.25; Xerox $11.20. 250 pages.

JAMES ANDREW CORCORAN: EDITOR, THEOLOGIAN, SCHOLAR (1820-1889)

(L. C. Card No. Mic 59-907)

Sister Mary Marcian Lowman, O.S.U., Ph.D.
St. Louis University, 1958

James Andrew Corcoran, eminent editor, theologian, and scholar of the nineteenth century, was the first native-born South Carolinian ordained to the priesthood for the Charleston Diocese. Born of Irish parents in Charleston, South Carolina, on March 30, 1820, James Corcoran was orphaned at the age of thirteen. Being sent in December, 1833, by Bishop England to pursue his studies at the Urban College in Rome, Corcoran was ordained to the priesthood on December 21, 1842. After receiving the degree of doctor of theology in 1843, he returned to the Charleston Diocese, where he served as assistant pastor at St. Mary's and the Cathedral in Charleston from 1843 until 1863. Between 1863 and 1868 he was pastor of St. Thomas Church, Wilmington, North Carolina.

Doctor Corcoran's extraordinary literary talents were manifested in his role as editor of the United States Catholic Miscellany from 1850 until 1861. Corcoran was compelled to wage constant warfare against the prevailing bigotry and anti-Catholic prejudice, and during the increasingly bitter sectional strife of the fifties, this fiery Editor took a strong stand for secession and showed a strong attachment to the South and its ideals. His polemical defenses of Catholic doctrines against Protestant attacks and his vehemently pro-Southern editorials during the Civil War crisis have merited for him a place among the greatest of American editors. In 1876, he became Editor-in-chief of the newly-founded American Catholic Quarterly Review, which position he retained until his death. His contributions to this scholarly journal as a reviewer, polemicist, and essayist have left a lasting impression upon the Catholic literary field.

Corcoran's profound theological acumen and intellectual stamina were seen most strikingly in his role as theologian at the Eighth and Ninth Provincial Councils of Baltimore, and as secretary at the Second and Third Plenary Councils. Playing a prominent part in drafting the schema for the Second Plenary Council and accompanying the American Bishops to Rome in 1883 as their consulting theologian to make preparations for the Third Plenary Council, Doctor Corcoran was most instrumental in drawing up the decrees of these Councils, which have exerted such a decided influence upon the Catholic Church in the United States. As theologian representing the American Hierarchy in the preparatory work for the Vatican Council in 1868-1869, Corcoran was outstanding in the stand he took regarding Papal Infallibility, despite the bitter opposition which he met. As counselor to Bishops, formulator of the decrees of the Plenary Councils, and defender of Catholic dogma, he shone as the outstanding American theologian of the century.

After his return from the Vatican Council, Corcoran assumed professorial duties at the Philadelphia Diocesan Seminary of St. Charles at Overbrook, where he spent the last eighteen years of his life. Renowned as a peerless Biblical scholar, pre-eminent in the knowledge of moral and dogmatic theology, gifted with a prodigious memory and intellectual insight, and remarkable in the mastery of Latin and the ancient languages, especially Syriac, Doctor

Corcoran was regarded as the greatest intellect in the Catholic Church of his time.

The Catholic Church in the United States sustained the loss of one of its most illustrious prelates in the death of Monsignor Corcoran on July 16, 1889. None in the nineteenth century had so ably defended the Church as had he in his threefold role of editor, theologian, and scholar.

Microfilm $6.35; Xerox $22.00. 499 pages.

A SOCIAL HISTORY OF THE EASTERN CHEROKEE INDIANS FROM THE REVOLUTION TO REMOVAL

(L. C. Card No. Mic 58-5164)

Henry Thompson Malone, Ph.D.
Emory University, 1952

During the first four decades of the nineteenth century the Cherokee Nation of Indians underwent remarkable social developments. When land-hungry Americans forcibly ejected these people from their Southern Appalachian homelands during the 1830's, the Cherokees had attained a standard of living peculiarly similar to that of their white neighbors. They resided on farms and plantations in homes ranging from log cabins to palatial mansions; many of them wore the traditional frontier costume, while the dress of some resembled stylish fashion-plates. Thousands of Cherokees had been educated and Christianized through the efforts of white missionaries and native converts. Many Cherokees used English, but the majority of the tribe had learned the eighty-six character syllabary invented by Sequoyah. Elected representatives carried on the affairs of a republican government; and a national bi-lingual newspaper kept the Cherokees informed, while proclaiming Indian progress to the world.

These developments were unusual for an Indian tribe. In earlier periods the Cherokees were chiefly concerned with the problems of daily existence in a strife-torn land. Warfare with other Indian tribes was a constant threat to security, and the early Cherokee government included separate "War" and "Peace" groups which functioned alternately as conditions demanded. When white men brought a new and more dangerous threat to existence, the Indians found themselves caught between the pressures of avaricious settlers and diplomatic intrigues. Thus prodded into an almost constant warfare with the white man, Cherokee existence during the latter part of the eighteenth century was troubled and insecure.

The Cherokee social structure of this early era, while picturesque, was basically primitive. Most of the Indians lived in rude huts or cabins made of poles and logs. Hunting and fishing provided most sustenance and clothing, although a rude agriculture produced corn and vegetables as dietary supplements. Elected Town Chiefs held most of the reins of government. In emergencies these leaders met in a national council. At various times, usually under white pressures, Cherokees chose or accepted a national leader, although this official was seldom able to control his nation effectively. Often the greatest influence was exerted by conjurors or shamans, whose utterances and actions were clothed with religious importance. Over all, a system of seven clans maintained a sort of loose unity in the Cherokee country.

But the activities of white men in the Indian nation disrupted the native pattern of existence and eventually engendered an important change in the social order. The stage for this transformation was set in the late eighteenth century with the forcible establishment of peace on the frontier. Numerous white men entered the Cherokee country for commercial, agricultural, religious, governmental, and other reasons. Each group brought a stimulus to Cherokee development. Traders and artisans residing in Indian villages suggested new modes of living, and gave the Cherokees mixed-breed descendants who led in the adoption of innovations. Land-hungry settlers pushed in, creating a two-fold influence: (1) Increasing land losses brought a stiffening of Cherokee resistance which contributed immeasurably to a desire for greater national unity; and (2) closer exposure to the white man's agricultural methods brought a greater knowledge of agrarian life. Missionaries and teachers promoted religious and educational advancement. Especially notable were the operations of the Moravian, Presbyterian, Methodist, and Baptist churches, as well as the American Board of Commissioners for Foreign Missions. A suddenly benevolent Great White Father deliberately encouraged abandonment of primitive ways and sent agents with tools and equipment to give instruction in the mastery of the white man's agriculture and domestic industry.

Under such influences from within and without, the Cherokees underwent a strange transformation. Many of them, especially the mixed-bloods, began to adopt the externals of the white man's existence. Clothing, diet, houses, farms, entertainment, and other characteristics of daily life began to show effects of the trend. Indians of initiative and energy improved their farms, and some became country gentlemen with plantations and slaves. A few built up thriving mercantile businesses, while others profited from ferries, toll-gates, and public-houses. The native government underwent a concomitant change. The adoption of written law in 1808, a republican reorganization in 1817, and the creation of a constitutional representative government in 1827 highlighted this legal progress. Many hundreds of Cherokees benefited from the educational and cultural advancement offered by the missionary endeavor, while more than a thousand natives became active members of various white churches. Some Cherokee individuals became particularly outstanding Christians and served as inspiration for their red brethren.

A dramatic acceleration in this curious metamorphosis came early in the 1820's with the introduction of a native written language, the invention of a previously illiterate half-breed named Sequoyah. Apparently the nation was ready for this catalyst in Cherokee social transformation. Within three years after the official adoption of the syllabary, more than half the nation had learned to read and write its own tongue. The new literacy was of incalculable benefit to commercial, religious, cultural, agrarian, and individual progress. The next decade witnessed what was probably the high tide of early nineteenth century progress along the "white man's road." The literary climax was the creation of a prolific national press, and the emergence of a national bilingual newspaper dedicated to Indian welfare and justice, the Cherokee Phoenix.

Crossing threads in this pattern of Cherokee development were created by native reactionaries, largely among the full-bloods. Their failures to follow in the "white man's path" caused the retention of tribal customs and procedures in some phases of Cherokee life. During most of this era,

however, progressive mixed-breeds dominated the native government and thus to a large degree were responsible for the nation's progress.

But by the 1830's the high tide of Eastern Cherokee social development was ebbing. At a moment of great promise for Indians moving impressively toward the white man's way of life, the white man himself obstructed that progress by thrusting the Cherokees out of their native lands. Left behind were the remnants of a once-promising nation--houses, cabins, farms, ferries, schoolhouses, and here and there an occasional fragment of Sequoyan print. These relics of departing Cherokees were forceful reminders of the curious red-white amalgam which by 1830 was their peculiar social order.

Microfilm $5.20; Xerox $18.40. 404 pages.

MISSISSIPPI AGRICULTURE, 1770-1860

(L. C. Card No. Mic 58-5167)

John Hebron Moore, Ph.D.
Emory University, 1955

Mississippi Agriculture, 1770-1860 is a study of the evolution of agriculture in Mississippi from the primitive subsistence farming of the English settlers of the Old Natchez District of West Florida to the complex commercial agriculture of the cotton planters of the 1850s. It deals mainly with the changes that occurred in farming methods, organization, crops, implements, and livestock during the ante-bellum period. It also analyzes the forces that were responsible for those developments: the economic factors, the work of individual agricultural leaders, and the influence of agricultural developments taking place outside of the state. Slavery is neglected as far as possible, because that aspect of the problem has been covered adequately by Charles S. Sydnor's monograph, Slavery in Mississippi.

Mississippi's agricultural history prior to 1860 falls naturally into four chronological divisions. The first of these was the era of experimentation lasting from 1770 to approximately 1800, a period that roughly corresponds to the provincial stage in the development of the state. The second began with the adoption of cotton as the staple crop around 1800 and ended with the onset of the great depression of 1837. The third, and most significant period, was covered by the depression years, 1837-1849. The fourth was the interval of prosperity between the close of the depression and the coming of the Civil War--the golden age of agriculture in Mississippi.

The 1770-1800 period of Mississippi history was a time of experimentation when the inhabitants of the Old Natchez District were seeking a profitable staple crop. From the start they had realized that subsistence farming did not provide a satisfactory basis for their economy. Besides food, they needed commodities to exchange abroad for manufactured goods. During the period of English dominion, therefore, they shipped lumber, barrel staves, cotton, pork, corn, tobacco and indigo to New Orleans and the West Indies to pay for their imports. After Spain gained possession of the region during the Revolutionary War, tobacco became the principal crop grown there. The Spanish government encouraged tobacco production by a subsidy until 1790, and, at the same time, allowed Natchez produce to be driven from the New Orleans market by cheap corn and pork from Ohio and Kentucky. The result of these policies was to turn Natchez farmers away from subsistence farming to production of tobacco for export.

Natchez tobacco farmers were prosperous until the crop subsidy was withdrawn in 1790. Then they were brought close to disaster by collapse of the New Orleans tobacco market. Those who could, shifted to cultivation of indigo the following year. Insects, however, prevented this experiment from being successful, and by 1793 indigo planting was abandoned. Of necessity, Natchez farmers then turned to cotton, the only remaining crop of the District that offered any hope of profits.

Providentially, 1793 was also the year of the invention of Eli Whitney's cotton gin. Travelers, who had seen his original model in Georgia, brought its description to Mississippi, and local mechanics built successful machines there on Whitney's principle. With this gin to clean the cotton and a press invented by David Greenglass to pack it for shipment, the new cotton planters were well equipped to take advantage of the prevailing high cotton prices. And, by 1800, cotton growing on an extensive scale had passed beyond the experimental stage, and cotton had become the acknowledged staple crop of the Old Southwest.

In the second period of Mississippi's agricultural history, between 1800 and 1837, farmers improved their methods of cultivating cotton and vastly expanded the acreage devoted to the staple. Following the lead of William Dunbar and Rush Nutt, Mississippians learned to plant their crops in rows that could be worked with the plow; and before 1830 they adopted the practice of running their rows along contour lines in order to minimize damage from erosion. They also began to rotate their crops of cotton with crops of corn and peas, and they learned from Nutt to plow under their peavines and cornstalks. Their great achievement of the period, however, was the development of a new and superior variety of cotton.

Between 1800 and 1830, a number of planters living along the Mississippi river succeeded in crossing the Javanese cotton brought in by the French with Georgia Upland cotton originally from the West Indies and a variety that had been cultivated for centuries by the Indians of Central Mexico. The new cotton, called "Mexican Cotton," combined the better features of the parent strains, and it quickly became the standard variety of the Old South.

The last seven years of this period was a time of feverish prosperity in Mississippi. The northern half of the state was made available for settlement after 1832 by removal of the Indians, and extremely high cotton prices lured hordes of prospective cotton farmers into the "New Purchase" region. The land rush--and the prosperity--came to an abrupt end, however, with the arrival of the panic of 1837.

Mississippi agriculture changed greatly during the depression of 1837-49. Low prices for cotton compelled planters to learn how to cut their costs of production. They reduced their expenditures of cash by growing their own food and livestock and by manufacturing farm implements and Negro clothing at home. They learned to grow more cotton, corn, peas and sweet potatoes per farm hand by adopting labor saving farm implements and improved cotton varieties, and they developed new techniques of soil conservation. Consequently, by 1849 they were able to make money at prices that would have been ruinous a decade earlier.

In this period of agricultural reform, the farmers of Mississippi learned much about their business from reformers of Europe and other sections of the United States. They subscribed to many agricultural periodicals, which made the latest advances in agricultural science available to them, and they organized agricultural societies for the interchange of information among themselves. Local agricultural leaders rose to the occasion, and some of them made contributions of lasting value to Southern agricultural progress. It was, in fact, a time when Mississippi farmers temporarily overcame their ingrained opposition to change.

When cotton prices reached comparatively high levels again after 1849, Mississippi farmers were in a position to benefit. They were growing cotton very efficiently and cheaply, and they were producing most of their own supplies at home. Consequently, many planters became wealthy during the 1850s, and large numbers of small farmers were able to attain the coveted planter rank. Agricultural progress, however, did not keep pace with the accumulation of wealth. Both planters and farmers tended, now that times were good, to revert to their old habit of planting cotton almost to the exclusion of all else. They continued to be interested in new implements and machines that would increase production of the staple, and they continued to practice improved methods of soil conservation. But they neglected livestock raising and diversification of crops. They were, in fact, farming much as did their descendants in the 1920s.

Indeed, Mississippi agriculture in 1860 had a distinctly modern flavor. Cotton farmers were using the same horse-drawn implements--the turning plows, cultivators, double shovels, rakes, harrows and seed planters--that were common during the 1920s. While they possessed no cheap commercial fertilizers, they were using legumes in the same manner as they do today. Their soil conservation techniques--including horizontal rows and drainage ditches, and grasses--were almost exactly those used at the present time. They lacked insecticides and hybrid corns, but they managed to produce yields of both cotton and corn that would not be considered small by modern standards. True, they failed to check the damage to the land caused by erosion, but so have later generations failed in that same endeavor. Far from deserving the title of the world's most destructive farmers, the cotton growers of ante-bellum Mississippi were worthy of respect. Given the scientific knowledge available to them and the problem of producing row crops on a large scale, it is doubtful that any other agriculturists could have surpassed their achievements.

Microfilm $4.75; Xerox $16.00. 372 pages.

CHRISTOPHER GADSDEN AND THE AMERICAN REVOLUTION

(L. C. Card No. Mic 59-1114)

James L. Potts, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Jack Allen

The purpose of this study was an historical evaluation of a long-neglected major figure in the American Revolution. Christopher Gadsden of South Carolina has ranked along with Samuel Adams and Patrick Henry as one of the major leaders of that movement. Despite his reputation, Gadsden has never been the subject of detailed study.

Findings of the Study

There can be little doubt that Gadsden has deserved his historical reputation. For eighteen years before the beginning of the War for Independence, he was an increasingly potent political figure in South Carolina. In that time, he was gradually converted to a revolutionary attitude, and he used his political skill and power to lead others in the same direction.

It is also clear that he was not a revolutionary in the sense that he sought to overturn society. He was dedicated to the English political ideals of the seventeenth century, and his aim was to conserve rather than alter. His dedication to a political ideal was so intense as to amount to moral fervor. He could neither accept change nor remain silent in the presence of what he considered to be threats to his sacred political system. Believing that Britain's political system was sacred, he began his career as an imperial patriot. He eventually became a rebel in deed because he saw no other way to save English liberty.

Gadsden did not actually make a revolution. He was an essential part and product of his circumstances. The conditions of his own development created the attitudes that led him to rebellion. The circumstances of his time made it possible for him to be a political leader. Even as a leader, his role was less the creation of situations than it was to interpret, justify, explain, and rationalize the events of his time in a manner tending toward revolution. His most important contribution was to collect diverse grievances and direct them against the British scheme for imperial reform.

This study traces the circumstances and direction of Gadsden's development from an imperial patriot in 1757 to the American patriot of the Revolution. It is essentially a study in the development of the revolutionary individual and his outward actions. The individual emerges clearly, but the measure of his influence remains obscure. All that is possible with existing evidence is to demonstrate that he had some influence.

Microfilm $5.35; Xerox $18.80. 418 pages.

THE FRENCH ACADEMY AND THE THIRD REPUBLIC, 1897-1914

(L. C. Card No. Mic 59-1237)

Herman Edward Slotnick, Ph.D.
University of Washington, 1958

The French Academy has occupied a unique position in French life. Originally founded to honor men of letters, the Academy early broadened its scope to include men from various professions. Through its members, the Academy has participated in most of the controversies which have divided the French since the middle of the seventeenth century. At times in its history, the Academy has been dominated by men hostile to the regime in power, at times by those sympathetic.

This study is concerned with the Academy in the years from 1897 to 1914, from the Dreyfus Affair to World War I. An attempt has been made through an examination of the views of the Academicians on major problems confronting France in the period to ascertain the attitude or attitudes of the Academy as a body to the Republic and to see what correspondence there was, if any, between the views of the Academicians and the course of Governmental policy. This study has also attempted to trace the changing character of the Academy in terms of the composition of its membership and to see what significance there was, if any, in the various Academy elections of the period.

The writings of the Academicians have furnished most of the materials for this study. Although it has not been possible to obtain full coverage of the Academy, a good sampling of the opinion of the Academy on specific issues has been presented.

In 1897 the Academy was well divided between men of public affairs and literary men. It included representatives of all political groups with the exception of the extreme Left. In this Academy the republicans actually constituted a minority.

From 1897 to 1914 the Academicians exhibited much interest in problems facing France. They were not, however, united in their judgments on the solutions offered by the various ministries of the period to these problems. In the first of these issues, the Dreyfus Affair, the Academicians had been overwhelmingly anti-Dreyfusard, though avowing their support of the Republic. Only one member joined in the conspiracy against the Republic during the Affair.

The Academicians were most critical of the Government's handling of the religious question. In particular they condemned the persecution of the teaching orders and the attempts made to secure a monopoly of education for State schools. The Academicians were almost equally divided on the merits of separation of Church and State.

Most of the Academicians averred that the Republic had failed to solve the social question. They believed that only positive action by the State could ameliorate the conditions of labor. As reformers they were cautious men and against radical change in the social structure of the State.

Most of the Academicians were highly critical of the French parliamentary system. Some felt that improvement was impossible under a republican regime, but the majority advocated practical reforms to strengthen the parliamentary system.

As a group the Academicians were most interested in foreign affairs. They supported the vigorous colonial policy of the Republic, the Russian alliance and to a lesser extent the English entente. They were much concerned with the problem of Alsace and Lorraine. The Academicians became much more ardent supporters of French foreign policy later in the period than they had been earlier.

A number of changes had taken place in the character of the Academy during the period. In 1914 there were more novelists and fewer historians, two philosophers had been added, and the arts and sciences were no longer represented. The Academy contained more republicans in 1914 than in 1897. Nevertheless, the evidence is that political considerations did not much influence Academy elections.

Microfilm $3.00; Xerox $10.20. 230 pages.

THE CONSTITUTIONAL-DEMOCRATIC MOVEMENT IN RUSSIA, 1902-1906

(L. C. Card No. Mic 59-580)

Nathan Smith, Ph.D.
University of Illinois, 1958

The Constitutional-Democratic movement was Russian radical liberalism in action. It had its origin in the realization by certain progressive landowners that Russia could progress, prosper and enhance her state power only by following the path of political development marked out by the most advanced nations of the West. Working through the zemstvos, the constitutionalist gentry tried to organize public opinion of the enlightened upper classes as a means of influencing the government to undertake basic political reform.

The zemstvo movement had no success in the 19th century but by the beginning of the 20th it had attracted the interest of the radical, non-revolutionary intelligentsia. Despite differences in ultimate aims, both groups shared a fundamental goal: the achievement of political and civil rights and a representative form of government while avoiding a violent social upheaval.

Lacking a political tribune of their own, the radicals were at first content to let the zemstvists take the lead. When the gentry failed to convince the government that zemstvo delegates should be allowed to participate in the drafting of legislation, the radicals began a drive for leadership in the liberal movement. The first result was the organization of a zemstvo congress in November, 1904 which openly demanded political rights and a national assembly with power to legislate, control the budget and supervise the administration.

The November congress marked the high point of liberal reliance on the zemstvos as a primary source of pressure on the government. In 1905 the radical intelligentsia began to speak for itself, through various professional unions and other organizations, and to insist that its aims be given formal recognition. Strongly influenced by Russia's military defeats and by the nascent revolution which followed Bloody Sunday, the liberal zemstvists accepted a modified version of the intelligentsia's democratic, social-economic and autonomy demands. When the Constitutional-Democratic party was formed, in October, 1905, its program was considerably more radical than the one which the zemstvo-constitutionalists had evolved by the beginning of the 20th century.

Radicalization of the liberal program was an acknowledgement of the need to win the support of the masses to the cause of political liberation. The government had refused to adopt the moderate reform program of the zemstvos. It had proclaimed reforms belatedly and insincerely, under pressure, and had provoked a revolution by its policies of internal repression and foreign conquest. Willy nilly, the constitutionalists had to revise their goal of preventing revolution to that of leading it into peaceful channels. For this they needed the support of the radical intelligentsia. Left-wing leadership in the constitutionalist movement was thus fostered by the growth of crisis and by the government's lack of ability to cope with it in a constructive way.

As long as it was possible to believe that every oppositional group was working for the immediate goal of political reform, the Constitutional-Democrats maintained

the slogan of a united Liberation front. After October, 1905, however, it became evident that the revolutionary parties were pursuing more advanced aims. Faced with the dilemma of supporting a government which was basically unreformed or a revolution which went beyond desirable bounds, the Constitutional-Democrats did neither, vainly hoping that the new State Duma would provide a third alternative.

Constitutional-Democratic success depended on the creation of a unique force —national public opinion— which would be powerful and yet restrained. It must be strong enough to convince the government of the hopelessness of delaying radical reform and restrained enough to avoid a general political-social cataclysm. The greatest failure of radical liberalism was its inability to create such a force. Microfilm $7.05; Xerox $24.20. 553 pages.

BRITISH INVESTMENTS AND THE AMERICAN MINING FRONTIER, 1860-1901

(Publication No. 24,687)

Clark C. Spence, Ph.D.
University of Minnesota, 1955

Like other corners of the world, the so-called "last" mineral frontier of the American West received its share of capital investment from Victorian England. From 1860 to 1901 at least 274 British joint-stock companies were incorporated and actually engaged in mining activities in this trans-Mississippi region. It is probable that the total capital involved may have been as high as £40,000,000 or £50,000,000 for the period.

Such a capital movement was not wholly spontaneous. In part it came as the result of energetic promoters who helped provide both stimulus and direction. Whether English or American, amateur or professional, whether working alone or in conjunction with others, the promoter inevitably relied on the sales techniques which were universal in his day. Sensational prospectuses, glowing reports from mining "experts" in the field, promises of fabulous profits, and the use of titled "guinea pigs" as directors were all standard devices calculated to blind the already nearsighted English investor.

Misrepresentation was common. Valueless or exhausted mines were palmed off at outrageously high prices. Occasionally concealed mortgages or even a few "salted" ore bodies were involved. At the least, the property offered was generally overvalued. Too late, the naive British investor usually found that he had no satisfactory recourse through the courts at home or in America. Company laws proved loosely drawn, while shrewd promoters walked a narrow line just inside legal bounds.

Miscalculation or the widespread use of founders' or vendors' shares often brought over-capitalization or a lack of working capital and impaired mining operations. Manipulation of shares on the London market created additional hazards and all too frequently, as in the case of the Emma Silver Mining Company, Limited, vendors and promoters were associated with mine sales primarily for speculative reasons, to the detriment of the bona fide investor.

Once organized, the British concern encountered managerial problems stemming from inadequate personnel or from absentee ownership. Directors selected for the prestige of their names sometimes lacked even rudimentary knowledge of mine or company operation. Experts sent out to manage the mines might prove capable men or they might be imerior or of independent temperament, difficult to control from London.

Nor could British firms keep from being swept into the same litigious whirlpool that sucked down to oblivion so many American companies. Clever Yankees, more liberally endowed with ambition than with scruples, took advantage of the Englishman's ignorance of American mining law to force constant litigation or to levy "legal blackmail."

Despite restrictions placed on aliens by the mining law of 1872 and by the Alien Land Law of 1887, the Federal Government was consistently lax in initiating action and its policy toward foreign mining corporations was in practice fairly liberal. The British Government displayed only an occasional interest in problems attending investment in western mines, even during the potentially explosive Emma affair of the 1870's.

Returns fell far short of the initial outlay. Of those companies registered between 1860 and 1901, at least fifty-seven--about one in ten--had by 1915 paid dividends totaling £11,750,770. But shareholders' repeated complaints and not less than one hundred corporate reconstructions indicate further that investments were not normally profitable ones.

Yet the impact on the mining frontier was a positive one. Successful British concerns became local economic mainstays. Much-needed capital was provided for an industry in transition. Skilled personnel and technological improvements from the old world followed the flow of capital and contributed substantially to the development of the new.

Microfilm $8.15; Xerox $27.80. 644 pages. Mic. 59-1928.

THREE GERMAN UTOPIAN SOCIALISTS: LORENZ VON STEIN, KARL MARLO, AND MOSES HESS

(L. C. Card No. Mic 58-7058)

Horace John Weiss, Ph.D.
Columbia University, 1958

This study analyzes the nature of German socialism during the Vormaerz by discussing the thought and experience of three Socialists: Lorenz von Stein (state Socialist), Karl Marlo (guild socialist), and Moses Hess (social Anarchist). Although they did not arrive at the same conclusions, they have been dealt with together because they shared those assumptions which, in the history of socialism, have been called utopian in contrast to the "scientific" socialism of a later time. The works of these three Socialists demonstrate the way in which utopian ideas were put to use in Germany during the eighteen-forties.

Stein, Marlo, and Hess have not been presented, however, as mere "precursors" of Karl Marx, nor have their ideas been contrasted unfavorably with his. Instead, their utopianism has been explained and -- it is hoped -- justified, and its sources indicated. Like many radicals of the time, Stein, Marlo, and Hess drew upon two sources of inspiration: German philosophical idealism and French utopian socialism.

Before the eighteen forties, socialism was hardly known in Germany; and all three radicals first became acquainted with it in Paris or through the works of such men as Saint-Simon, Fourier, and Louis Blanc. Following the French Utopians, Stein, Marlo, and Hess came to value class co-operation as a means for introducing socialism, rather than sudden and bloody revolution, and they insisted upon the power of ideas and ethics rather than the force of the laws of economics.

The study also shows all three theorists were made receptive to the moral idealism of the French Utopians through their commitment to some of the ideas of the German philosophical idealists. Indeed, it may be argued that through the influence of German philosophy, Stein, Marlo, and Hess became utopians before they became Socialists. Stein, an Hegelian of the middle, argued that only through state socialism could the state become truly the representative of the Moral Idea on earth, and he supported his arguments with Hegelian dialectical logic. Marlo, following Fichte, wrote a history of the development of man's moral awareness, and tried to show that only guild socialism could provide a truly moral society. Hess, a left or young Hegelian, held that the perfect order of perfect anarchy would be the final realization of the Absolute Spirit in history. The German Idealists, in fact, taught all three to regard mind and spirit as the supreme powers.

After explaining the utopian systems of each theorist, the Dissertation turns to their experiences during the revolutions of 1848, and shows how each --disillusioned by those experiences-- rejected his moral idealism. Stein joined the radical party in his native Schleswig-Holstein and, upon the defeat of the revolutionary groups by Denmark in 1850, was dismissed from his post at the University of Kiel. Convinced by the outcome of the Revolutions of 1848 that the problems of modern industrial society were too difficult to solve, he became a romantic-conservative longing for a return to the stability of the medieval Staendegesellschaft. Marlo led a congress of guildsmen in their attempt to apply guild principles to the industrial order of Germany, but the victories of free enterprise and the political reaction caused him to replace his arguments for the moral superiority of the guild order, with hard headed demonstrations of its superior productivity. Hess, leader of a radical German Worker's society in Paris and finally forced into exile by the governments of Prussia and France, was converted to scientific socialism by Karl Marx himself. But this was not the end: in the last Chapter Hess's final reassertion of his utopianism is described.

Microfilm $3.75; Xerox $12.60. 289 pages.

CRIME AND PUNISHMENT IN SOUTH CAROLINA, 1790-1860

(L. C. Card No. Mic 58-5192)

Jack Kenny Williams, Ph.D.
Emory University, 1953

The basic purpose of this dissertation is to trace the patterns of lawlessness and the mechanics of justice within South Carolina from 1790 to 1860. The study is focused on white citizens and deals only incidentally with Negroes.

South Carolina seems a logical state for such a study, not because she had an excessive amount of crime by comparison with her neighbors, but because she is and has been in many respects typical of the whole South. As one historian has aptly said, she bears the same relation to the South that Massachusetts does to the North.

The source materials used for this dissertation include the typescripts of the sessions courts' records for eighteen of South Carolina's twenty-eight pre-Civil War judicial districts; the letters and documents ("Penal Papers") in the state archives which pertain directly to the problems of crime and punishment; the manuscript grand jury presentments; various diaries and reminiscences, published and unpublished, of lawyers and other responsible citizens; the legislative journals, law digests, statutes at large, and superior court reports of the state; the commentaries of travelers and short-term residents; newspapers contemporary to the ante-bellum period; and printed monographs and articles touching on the theme of the dissertation. The typescript sessions courts' records are housed in the South Caroliniana library of the University of South Carolina. The "Penal Papers" and grand jury presentments are the property of the South Carolina Historical Commission.

The plan of this dissertation is: (1) a statistical view of the amount of crime in the state, taken for the most part from the court records and from reports of sheriffs, constables, and clerks of courts; (2) a discussion of the types of crimes committed and an estimation of the importance of each type; (3) an investigation into the causes of crime, with special consideration being given to the contemporary viewpoint; (4) an evaluation of the criminal in an effort to discover his or her age, education, and economic status; (5) a study of the methods by which criminals were apprehended; (6) a description of the circuit court system which tried the criminals; (7) a consideration of the work of the sessions court lawyer; (8) a description and discussion of punishments meted out to criminals; (9) an appraisal of the criminal system, the effects to reform it, and its importance as an indicator of certain social attributes of the ante-bellum South Carolinians.

The study shows that the prevalency of crime in South Carolina was about the same in 1790-1860 as today; and that no one area of the state was more criminal than another. Crimes against the person (murder, manslaughter, assault and battery, and rape) were the most spectacular misdeeds, while crimes against property (larceny, counterfeiting, and swindling) were the most detested. Crimes against public morals (bastardy, adultery, and the maintenance of nuisances) were the least important, but were more numerous than has been suggested by a number of historians of the Old South. Assault and battery was the crime most frequently committed; arson was the most feared; and, from the criminal's point of view, counterfeiting was the most successful.

In addition to the desire for quick financial gain, crimes were caused by such loosely related factors as "hot blood," gambling, whiskey, the widespread habit of carrying weapons, an influx of dishonest immigrants from other states, and poor law enforcement methods. South Carolinians seemingly made little attempt to pin to the problem of crime any of the now popular psychological or sociological causes.

The criminals themselves were a diverse group. They ranged in age from childhood to near-senility, in education from illiteracy to college graduate, and in economic status from the very poor to the fairly rich. Some were men or women of superior social background. Most were not.

Some were criminals by profession, others as the result of momentary emotional unbalance. No single criminal or gang of criminals in South Carolina gained a notoriety comparable to that of many of their Western counterparts.

The criminals did not find the state necessarily a safe haven. They were chased by citizen posses, rural constables, and city police. In addition, private citizens often acted the part of detectives, adding their own awkward strength to that of the legal officers and the posses. The regular police, numbering about one for each one thousand residents, were brave and conscientious, but with the exception of the Charleston police force after 1830 they were not well trained for their tasks.

The judiciary which tried the captured criminals was either a five-man panel of two petty magistrates and three freeholders, or a law judge and twelve petit jurors. The first of these agencies played a minor role except in connection with Negro offenders. The bulk of white criminals were brought before the petit jury, which was made up of a representative cross-section of the state's tax-paying citizens, and were tried in accordance with English court procedures. The accused were defended by licensed lawyers who made use of bombastic oratory and who appealed to local pride and custom. Defendants were more often exonerated than convicted, and many of those found guilty were freed by the state executive -- whose power to pardon was virtually unlimited.

Those who were convicted and not pardoned were punished, if guilty of a capital crime, by public hanging; and if guilty of a less severe offense, by whipping, branding, banishment, fine, or jail sentence. Branding was discontinued after 1833, however, and whipping was in disfavor from the 1820's. Banishment was a favored punishment for criminals who tended to repeat their crimes, and for abolitionists. Fines were light, rarely amounting to as much as one hundred dollars for any offense, and were hard to collect. Jail sentences were, as a rule, for short terms. Jails were unhealthy, poorly administered, and badly constructed. Escapes from them were frequent. Philanthropic leaders such as Francis Lieber and Banjamin F. Perry importuned the state to build and operate a penitentiary system but their pleas were without avail until 1866.

The legal punishments were considered too severe by many South Carolinians and several proposals were made after 1812 to revise and humanize the penal statutes. A special effort was made to do away with capital punishment. These attempts were futile.

Mobs were rare in pre-Civil War South Carolina; but numerous citizen organizations calling themselves "vigilance societies" operated outside the law after 1840 to rid the state of abolitionists and "suspicious strangers." These societies were well led and carefully organized, and had the support of most citizens. Except in rare instances they did not mete out severe punishments. Generally they were content to banish their victims from the state.

The study of crime and punishment in South Carolina points up certain personality traits of the state's people which, in turn, help to explain their leadership of Southern secession and Civil War. Among these were a headstrong individualism, with a resulting disregard for legal conventions; an undemocratic class consciousness; and a growing, violently-expressed conservatism. In addition, this study shows similarities in the criminal history of the state for the nineteenth and twentieth centuries. Especially does it indicate that crime was no less a major problem, and that the morals of the aggregate people were neither appreciably better nor worse in ante-bellum South Carolina than in the modern state.

In fine, the story of crime and punishment is a limited chapter in the history of man's acceptance of the legal restraints of civilization. It appears that, in pre-Civil War South Carolina at least, he accepted slowly.

Microfilm $4.55; Xerox $15.20. 353 pages.

HOME EXPERIENCES OF NINTH AND TENTH GRADE MICHIGAN PUPILS OF VARYING ABILITIES

(L. C. Card No. Mic 59-749)

Jane S. Bemis, Ed.D.
The Pennsylvania State University, 1958

Home experiences provide the activity most often used in the homemaking program to bring school instruction and the home together. The term "home experience" is used interchangeably with the term "home project." Some authors include home practice in this definition. Home practice is described as an experience of small scope used to refine and maintain skills introduced in the classroom program. Criteria for home experiences require that they involve planning, securing new information, forming judgments, managing resources, and evaluating results. Over a period of years there have been indications that teachers need help in making home experiences effective learning experiences.

THE PROPOSED INVESTIGATION

This was a study of the home experiences of ninth and tenth grade pupils of varying abilities in Michigan.

The purposes were (1) to determine the kind and quality of home experiences that are being achieved by pupils of differing abilities in selected classrooms in Michigan with teachers who have been rated as effective by state supervisors of Homemaking and Family Life Education and (2) to determine the similarities and differences in achievement in home experiences for pupils of various levels of ability.

The investigator expected this research to reveal some techniques helpful to supervisors and teachers in strengthening the home experience program. In developing the study the following hypotheses were proposed: (1) the

criteria generally set up for effective home experiences are suitable and challenging for pupils of average ability, (2) pupils of high potential can do more than is being expected of them, and greater challenge can be provided for their creative, managerial, and leadership abilities, and (3) slow and retarded pupils do not have the ability to carry out home experiences as defined in the criteria representative of much of the thinking in the field of homemaking education.

SUMMARY OF THE PROCEDURE

The California Test of Mental Maturity was used to classify the 316 pupils in the study into three groups. One beginning high school homemaking class from each of 19 cooperating schools participated in the investigation.

The sample consisted of 58 pupils in the slow group with IQs ranging from 58 to 89, 203 pupils in the average group with IQs between 90 and 110, and 55 pupils in the superior group with IQs between 111 and 148.

Data for the study were secured by means of a teacher's evaluation check list and a pupil and parent questionnaire for each pupil in the sample. Home experience reports and teacher observations were secured whenever possible.

Techniques used by teachers in guiding the experiences were surveyed by means of a questionnaire. Achievement of the slow and superior groups was compared with the average using the chi-square test. Case studies were made to supplement group data.

SUMMARY OF THE FINDINGS

The findings of this study support the proposed hypotheses. The home experiences of both the slow and superior groups were less realistic in terms of personal abilities than those of the average. Fifty-one percent of the superior compared to 33 percent of the average and five percent of the slow group carried out home experiences which measured up to the criteria generally accepted in the field of homemaking education. Pupils in the superior group more frequently than the average used goals as guides, included their families in planning, and carried out experiences requiring abstract reasoning, organization of information, and problem solving. Goals grew out of a felt need in fewer instances and specific learning was recognized less frequently by the slow group. Few of their home experiences showed successful use of abstract reasoning, management of resources, or problem solving. In 84 percent of the cases for the average compared to 71 percent for the slow group, and 85 percent for the superior group, homemaking teachers considered the home experience had been handled successfully.

Microfilm $2.60; Xerox $9.00. 198 pages.

JOURNALISM

PAPERBOUND BOOKS IN THE UNITED STATES IN 1955: A SURVEY OF CONTENT

(L. C. Card No. Mic 59-477)

Eleanor Blum, Ph.D.
University of Illinois, 1958

The quality of paperbound books in print in 1955 has been analyzed by three criteria--the subject matter; the reputation of the authors in the opinions of critics, reviewers and fellow writers; and the sources from which paperbound publishers took their material (that is, whether it was reprinted, created expressly for paperback publication, or drawn from public domain).

Much of paperback publishing is intended for entertainment rather than for intellectual stimulation. Fiction is its main fare. Roughly 75 percent of the 4,868 titles were novels. This situation is diametrically opposed to that in hardcover publishing, in which only 14 percent of the new titles issued that year were novels. Other paperback output in fiction included mysteries, 19 percent; Westerns, 14 percent; and science fiction, three percent. About 500 of the 1,800 "straight" novels were not serious in theme. Approximately 400 of them belonged to an underworld of fiction called, in the jargon of the trade, "sexies," and the other hundred were light humor and historical romances.

Poetry and drama accounted for two percent of all titles, and nonfiction for the remaining 23 percent. Nonfiction titles were divided almost evenly between books of the "how to" variety and those which probed more deeply.

In the quality of their writing, authors ranged from excellent to poor, with the majority on middle ground. In this respect, softcover publishing resembles hardcover publishing. Although reputations varied, most writers could be easily identified with their genres. Paperbound published selected established authors, or, for nonfiction, subject specialists. They have produced few writers of their own, although they tended to draw upon pulp magazines for softcover fiction originals.

Of the 4,868 titles, 3,217 were reprints; 1,343 were from original manuscripts; and 252 were from public domain. (The source of 52 could not be determined.) In selecting titles for reprint, publishers used 204 hardcover firms instead of concentrating upon a few. Generally they chose the most titles from houses whose publishing programs resembled their own. That is, they were general and diversified rather than specialized. Higher-priced lines, however, were beginning to draw from the university presses, of which they were sometimes a part. Ninety percent of the reprinted titles came from extant American firms, most of which had good, often excellent, reputations.

Within the fiction category, softcover originals occur much oftener in Westerns, science fiction and mysteries than in straight novels, and the more frequently they are found within a given genre, the better the reputation of the writers. Lighter genres lack the reviews and literary

prestige accorded the straight novel; consequently, well-known writers of science fiction, Westerns and mysteries (especially the two former), are more likely to forego bookstore sales than are serious novelists. In nonfiction, paperback originals are also quite prevalent, probably because publishers withhold nonfiction for their own backlists. Because of inavailability, softcover lines create their own titles, often written by subject specialists or by qualified free-lance writers. Whether fiction or nonfiction, those genres most closely allied with the magazine industry produce the most paperback originals. For example, more nonfiction, Westerns, science fiction and mystery stories appear in magazines than do straight fiction, drama and poetry.

In conclusion, the overall quality of paperback books is good. Publishers are using recognized hardcover firms and recognized authors for material, and they do not necessarily limit themselves to name writers and best sellers. They do, however, place emphasis on light fiction. Also, the more serious the subject or its treatment, the more expensive the book is likely to be and the less chance that it is sold through mass market outlets.

Microfilm $4.75; Xerox $16.00. 371 pages.

SOCIO-ECONOMIC FACTORS ASSOCIATED WITH COMMUNICATIONS BEHAVIOR OF FARM OPERATORS IN SELECTED WISCONSIN COMMUNITIES

(L. C. Card No. Mic 59-1383)

Lloyd Russell Bostian, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Bryant E. Kearl

This study was designed to determine the specific ways farm operators in selected Wisconsin communities spend their time, especially time spent with mass media of communications, and to relate mass media time use patterns to various socio-economic data concerning the farmer and his farm operation.

Farm operators in six Wisconsin communities were interviewed and asked to keep time use diaries. Diaries and questionnaires for 488 individuals were IBM analyzed at the University of Wisconsin Numerical Analysis Laboratory. Resulting cross-tabulations were subjected to test by Chi-square.

Behavior patterns of farmers who participated with specific mass media on a given day were compared to behavior of farm operators who did not participate with those media. Thus "readers" were compared to "non-readers" of magazines and newspapers, radio "listeners" to "non-listeners" and television "viewers" to "non-viewers".

The analysis also examined mass media habits of two groups of farm operators -- (1) low income farmers and (2) part-time farmers -- farmers with off-farm jobs.

Results show that the modal group of farm operators had access to one daily newspaper, one weekly newspaper, three farm magazines, one general magazine, two working radio sets, and one television set.

The farm operator used these mass media an average of three and one half hours per sample day. He averaged one and three quarter hours a day in face-to-face communication with people outside his family through visiting and farm business off the farm.

Thus the farm operator spent an average of five hours per sample day in some type of communication outside his family.

Relating socio-economic data to this time use information produced the following major conclusions:

Farm operators with varying degrees of education didn't differ significantly in amount of time spent with mass media, and this was true even of the printed media.

Farmers who spent time reading on a given day were also likely to spend time listening to the radio, but were less likely to watch television than non-readers were. Reading and radio listening were thus related, while being slightly negatively related to television viewing.

There was less total physical availability of mass media in the home of the low income farmer, yet he didn't differ significantly from the farmer with high income in time spent with any of the media.

The part-time farmer was less likely to have as many newspapers and magazines or as many radio sets in his home as was the full time farm operator, but was more likely to own a television set. Correspondingly, he spent more time watching television and less time reading and listening to the radio than did the full time farmer.

Finally, it appears that farm operators in Wisconsin have access to, and spend considerable time with, mass media daily -- in many cases access and use equal to the best estimates available for urban dwellers.

Microfilm $2.30; Xerox $8.00. 175 pages.

LANGUAGE AND LITERATURE, GENERAL

THE VILLAINS IN THE MAJOR WORKS OF NATHANIEL HAWTHORNE AND HENRY JAMES

(L. C. Card No. Mic 59-1380)

James Robert Bashore, Jr., Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Harry Hayden Clark

A brief discussion of some theological and secular attitudes toward evil proposes a three-fold test of villainy: "essence" (the nature of the villain's evil), "motive" (the reasons for his actions), and "deposition" (how he is "thrown down"). Subsequently, each of the two major sections (Hawthorne, James) is introduced by a condensation of scholarly opinion about the author's ethics (e.g. his attitude toward free will) and aesthetics (e.g. his attitude toward allegory). Augmenting this background with the author's journals and letters, and using the three-fold test, each section comprises (1) a genetic survey of the kinds of villains which appear in all of the writer's novels and in most of his short stories, and (2) an evaluation of the relative success with which the villains violate the author's ethics and aesthetics.

The first section of the study contends that Hawthorne's conventional villains are early modified by the texture of New England legend and morality to become introspective, sinful egotists who are yet conscious of social alienation. Until Twice-Told Tales these vilains are usually doubters, but by the mid-1840's they more specifically equate power or intellect with love. The study argues that in The Scarlet Letter Hawthorne most successfully balanced "essence" (in this case, hypocrisy) with other aspects of evil, though the changing types of villains (e.g. the zealot, the charlatan, the Past) often reflect specific events and interests of Hawthorne's life. In his final, "Italianate" villains, Hawthorne fails to integrate motifs of sin with motives of crime. Before that failure, his villains indicate that Hawthorne's gradual ethical development reaches high peaks at rather wide intervals.

The second section of the study, in contrast, argues that James's villains develop in fairly regular four-year phases marked by aesthetic as well as ethical shifts, each major novel subsuming the qualities of villains in a preceding run of short stories. For example, the mistrust and cowardice so prominent in James's first stories are combined in the villain of Watch and Ward; another series characterizing the evil of coercion or lack of self-control leads to Roderick Hudson; subsequent representative series deal with villainous arrogance derived from social position (culminating in The American) and immoral aestheticism, culminating in The Portrait of a Lady, which illustrates how James's manner of deposing villainy also changed. James's later villains often posses a "brutality of good conscience" and are sometimes ranked as "radicals" or "conservatives" involved in "the muddle of fate." In his stories after 1887, James characterizes the "modern" villainy of invading the private life; and, following the failure of his play "Guy Domville," he develops a series of stories presenting the villainy of non-appreciation (culminating in The Spoils of Poynton). After the stories of conflict between corruption and protection (1897-1901), James turns an "ethical somersault" so his good people can "live" and he allocates to them motifs previously reserved for his villains. James's last works evince interest in the businessman as villain, but his imperfect knowledge of that area forces him back to earlier strategies.

A short concluding section of the study summarizes the contrasts and comparisons of the villains in the works of Hawthorne and James.

Microfilm $9.00; Xerox $32.00. 709 pages.

JOHANN HEINRICH VOSZ' STELLUNG ZU RELIGIÖSEN UND POLITISCH-SOZIALEN FRAGEN: EIN BEITRAG ZUR GEISTESGESCHICHTE DER GOETHEZEIT

(L. C. Card No. Mic 59-514)

Erwin William Goessling, Ph.D.
University of Illinois, 1958

The aim of this study is to investigate the religious, social, and political attitudes of the rationalist poet Johann Heinrich Voss. Like most of the "Aufklärer," Voss was particularly concerned about these matters. Upon reading his poems, one will find few that do not in one way or another touch upon these questions. This holds true to an even greater degree of the polemics which he directed against Stolberg and the romanticists. He intervened in these matters (Zeitprobleme) and used the position of poet to propagate his own eudaemonistic and utilitarian theories (Glückseligkeit- und Nützlichkeitslehren). All of his writings suffer from his didactic intent. As he grew older this tendency increased more and more until he finally fought fanatically and tenaciously against any religious, social, and political theories that did not agree with his narrow and intolerant views: Preaching tolerance he was yet most intolerant.

The method of investigation employed in this study is as follows: The first two chapters delineate in chronological order Voss' general position and attitude in respect to religious and social and political problems as evidenced by his own writings and by statements of contemporaries about him. The third chapter endeavors to show how his views on these matters affected his relationship to Fritz Stolberg. The rupture of their friendship was, for all practical purposes, caused chiefly by their opposing views or at least by Voss' misunderstanding of Stolberg's position. The last chapter treats of Voss' attitude toward romanticism. Again the opposing views on these problems turned Voss into a fierce enemy of this movement.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The study reaches the following conclusions: Voss was not devoid of religious feeling. He believed in a personal and omnipotent God and in immortality. Frequent references to these ideas are prevalent in his poetry and other writings, especially his earlier works. He demanded that like all phases of life, faith should be tested by reason. Everything that failed this test was to be cast aside as being superfluous and even damaging to true religion. From this attitude stems his attack against all dogma and particularly against the concept of apositive and revealed religion. He opposed not only the Catholic Church but also all deeper religious impulses on the side of the Protestants. Although he considered himself to be a member of the Protestant-Christian faith, he was in reality outside the orthodox community, which accepts the tenets of original sin and redemption through Christ. In his views he seems to come perhaps closest to the Unitarian position.

In social and political matters Voss shared the views of the rationalists. He fought vehemently against the institutions of nobility and serfdom. Although in theory he championed social equality and political liberty, in practice he welcomed a strong autocrat, who usurps the prerogatives of the aristocracy and thus equalizes "Bürger" and nobility. In the French Revolution he welcomed above all the elimination of social inequality.

Voss turned against Fritz Stolberg because the latter adopted the Catholic faith and did not see eye to eye with him on the French Revolution. This to Voss was tantamount to joining the reactionary forces. It is furthermore ironic that Voss, who himself rejected the confessional tenets of Protestant Christianity, should denounce this step as un-Christian.

Any understanding between Voss and the romanticists was out of the question, since Voss abhorred their leaning toward Catholicism and their championing of feudal institutions, and the romanticists on their part ridiculed Voss' rationalistic theories.

Microfilm $2.55; Xerox $8.80. 195 pages.

SHAKESPEARE'S TREATMENT OF THE VIRTUE OF PATIENCE

(Publication No. 24,367)

Ruth Mickelson Levitsky, Ph.D.
University of Missouri, 1957

Supervisor: Hardin Craig

This study seeks to discover how Shakespeare at different stages in his development as a dramatist portrays heroic behavior under adversity.

Chapter I sets forth three current but conflicting theories concerning the noblest manner of reacting to adversity: the Stoic advocacy of indifference to death and to all the "goods" of life save the pursuit of virtue; the Christian injunction to humble acceptance of God's will and charitable forgiveness of men's offences; the code of honor, according to which insult or injury demanded retaliatory action.

Stoic patience is seen to necessitate extirpation of the emotions and to demand punishment as a matter of justice; the honor code, to demand a controlled anger and vengeance; Christian patience, to employ love, hope, and compassion and to temper justice with mercy.

Before Julius Caesar, the prime motivation for a Shakesperean hero is seen to be honor. Christian patience is presented as a disastrously ineffectual weapon in the hands of Henry VI, while the heroic Henry V admits the love of honor and the uses of anger. Stoic patience is scarcely attempted in these early plays except in Richard II's half-hearted efforts at self-mastery. In general, man's right to exercise his emotions is insisted upon. The completely unfeeling character is villainous.

In the portrayal of Brutus, Shakespeare shows an interest in the possibility of heroic action unaided by emotion. Brutus, however, falls short of the Stoic ideal of apathy. In Troilus and Cressida, honor wins over patience in formal debate. Troilus conceives of patience as the temporary control of anger. Hamlet admires both Stoic indifference and "divine ambition." He concludes that the proper use of Reason is to aid one in acting honorably and in remaining indifferent to the consequences of that action.

After Hamlet, the gentler passions are consistently presented as more laudable than either anger or the lack of passion. Uncompromising justice is denounced. Efforts to reason away the affections fail. Othello discovers the unbearable not in loss of honor, but in loss of love. Though he can sentence Desdemona with cold justice, he can kill her only in passion.

Christian patience, as exemplified in the long-suffering and forgiving attitude of Desdemona, Cordelia, and Edgar, is presented as more praiseworthy than Stoic patience or defense of honor. Lear comes to understand patience as something more than controlled anger. Though he does not learn complete patience from either the Stoic or the Christian point of view, he achieves an indifference to certain injustices and an acceptance of certain deserved punishments. Gloucester discovers that man must patiently endure life until the gods see fit to terminate it.

In Timon, Stoic indifference carried to its logical extreme reduces man to a primitive or a bestial state. The "Stoic" magistrate proves to be less noble than the honor-seeking but merciful soldier. Coriolanus, too, learns to place mercy and compassion above honor or immovability.

In the romances, Christian long-suffering and forgiveness continue to constitute the most acceptable manner of meeting adversity. Punishment of the wrong-doer consists in his living with his own bad conscience. Repentance, with the consequent salvation of the sinner, is the end of punishment. Man's weapon against evil is not indifference or anger, but prayer.

Microfilm $3.10; Xerox $10.60. 237 pages. Mic 59-1929.

A STUDY OF THE LANGUAGE OF ELOQUENCE AND THE PRINCIPLES OF DECORUM, VERISIMILITUDE, AND IMITATION IN THE PLAYS OF GEORGE CHAPMAN

(L. C. Card No. Mic 59-920)

Sister Mary Grace Schonlau, C.S.J., Ph.D.
St. Louis University, 1958

This study has examined the language of eloquence and the principles of decorum, verisimilitude, and imitation as

found in the dramas of George Chapman. A review of the rhetorical heritage shows that the poet had ample opportunity to learn the proper idea of classical restraint and decorum from his grammar-school training or from the popular texts prepared by the Tudor rhetoricians.

Chapter II presents the theory of eloquence as it developed under sophistic and medieval influences and shows that during the Renaissance, as during the Middle Ages, eloquence was valued as the expression of man's superiority and that it was most frequently interpreted as the ability to amplify and embellish writing with the flowers of rhetoric. Chapman exhibits a love of exuberant language although he expresses the classical theory that matter and form must be blended with art and decency.

An analysis of Chapman's language of eloquence as expressed in his use of the topics of invention and the obvious figures of repetition forms the content of Chapter III. This investigation shows that, although the multiplicity of figures in his works suggests a reliance upon the medieval concept of rhetoric as style, Chapman nevertheless subjugates his ornamentation and amplification to the demands of the art of correct and effective communication. He is most medieval in the pronounced sententiousness and in his use of paradigma and fables. His fondness for similes and metaphors, as well as for the figures of repetition, is carefully controlled to illustrate more clearly the serious or comic nature of the scene, or to accentuate emotional changes in the characters. When he uses definition, notation, and conjugates, he does so ordinarily for persuasion and emphasis. Although he lapses occasionally into pendantry, he counterbalances his failures by his use of metaphorical and figurative language.

Chapters IV and V show that Chapman manifests a typical Renaissance spirit of independence. Decorum of characterization appears primarily in his care to present consistent characters. He does not develop all his characters, but those which he does outline clearly are unified. An exception to this is found in Cynthia of The Widow's Tears and in Cato and Pompey of The Tragedy of Caesar and Pompey. His selection of characters shows great freedom. He ignores traditional social distinction in choosing persons from royalty in several of the comedies and he fails to use an historical figure as the hero for The Revenge of Bussy D'Ambois; however, he makes Clermont consistent and an example of universal truth.

Chapman allows himself great freedom with the laws of decorum when he ventures into the realm of tragicomedy in The Widow's Tears, The Gentleman Usher, and The Blind Beggar of Alexandria, all of which accent pathos rather than ethos to a marked degree. In Monsieur D'Olive he does not achieve a perfect blending of the two plots, romantic and satiric. However, he achieves other aspects of decorum, particularly that of proper portrayal of emotions even when he does not succeed perfectly in comic plotting.

In his manipulation of language, Chapman distinguishes between prose and verse for dramatic purposes. His comedies show his ability to achieve an easy conversational style; the tragedies illustrate decorum by their wealth of rhetorical ornamentation and amplification proper to the high style. His variation of diction, form, and style to fit emotion or character is a signal mark of decorum.

From the sum of sixteenth-century rhetorical heritage, Chapman drew his theories of imitation, verisimilitude, and decorum, which led to his adherence to the principle that drama is essentially an imitation of universal truth which it presents through the blending of matter and form with art and decency.

Microfilm $5.35; Xerox $19.00. 425 pages.

BACKGROUNDS OF ELIZABETHAN PASTORAL DRAMA

(L. C. Card No. Mic 58-7055)

Joseph Howard Summerell, Ph.D.
Columbia University, 1958

This study does not purport to be a systematic history of the pastoral drama, nor is it concerned primarily with the origins of pastoral. Its purpose is two-fold: to survey the classical and medieval backgrounds of the pastoral drama, its themes and components; and to analyze the pastoral plays of Tasso, Guarini, Peele, and especially Lyly, both in terms of the background described, and in connection with the themes of content and romantic love.

Chapter I describes the classical background of pastoral features such as the locus amoenus, the "discovery" of Arcadia, and the genesis of the satyr of Renaissance pastoral in the Italian pastoralists' mistaken belief that they were imitating a pastoral genre in which the satyr combined the functions of the lustful Greek satyr and the Roman satirist. Following an account of primitivism and pastoral, the pastoral ideal itself is discussed as it appears in Theocritus, Virgil, Calpurnius, Horace, and Ovid. The genesis of a pastoral philosophy in Seneca is considered, and finally the Greek pastoral romance Daphnis and Chloe is shown to anticipate the pastoral drama in its treatment of romantic love as a quasi-religious experience.

The second chapter continues the survey of the pastoral background into the Middle Ages. Although there is no body of pastoral plays in this period, the pastoral tradition itself is strong. Because in pastoral "nature" and "god" are equated, the fusion of these terms is traced in the writings of some of the church fathers. The three main ideals fostered in the Middle Ages, the Christian, the chivalric, and the pastoral, are considered in their relation to the pastoral drama. Following a brief digression on the pastourelle, the origins and functions of such pastoral features as the "wild man," the hermit, and the pleasance are considered.

"Pastoral" itself is so amorphous that pastoral drama, at least, has not been wholly satisfactorily defined. Nor can the reality which evokes the pastoral (and the satiric) impulse be objectively determined. Pastoral and its corollary, satire, are not reflections of reality, but reflections of attitudes towards reality. Accepting Guarini's description of pastoral as an adjective, not a kind, the pastoral plays before 1600 are discussed in terms of their pastoral elements. Peele's The Arraignment of Paris is examined, and Lyly's employment of pastoral is analyzed as an instrument ideally suited to convey his love doctrine as illustrated in Campaspe, Sapho and Phao, Gallathea, Loves Metamorphosis, Endimion, Midas, and The Woman in the Moone. The Maydes Metamorphosis (Day?) is the last pastoral drama considered.

Examination of these plays, plus those of Tasso and Guarini, leads to the conclusion that pastoral plays do not

constitute a distinct dramatic genre, but that a play, comedy or tragicomedy, the aim of whose setting, personnel, sense and sentiment is to invite comparison of reality with the ideality (usually idyllic love) associated with a pastoral community may be called a pastoral play.

Microfilm $3.45; Xerox $11.80. 268 pages.

LANGUAGE AND LITERATURE, CLASSICAL

THE VATICAN MANUSCRIPTS OF THE GREEK LETTERS OF BRUTUS

(L. C. Card No. Mic 59-886)

Ernest Joseph Ament, Ph.D.
St. Louis University, 1958

The collection of seventy letters entitled The Greek Letters of Brutus has up to this time appeared in two critical editions. The first, by Anton Westermann (M. Bruti Epistolae Graecae, Leipzig, 1855), was based on a study of five manuscripts. The second, by Rudolph Hercher (Epistolographi Graeci, Paris, 1871), augmented Westermann's work with a study of four additional manuscripts.

The purpose of this dissertation is to provide a detailed study of the Vatican manuscripts in order to ascertain their relationships to one another, to list their variant readings, and to determine whether they form a basis for modifying the textus receptus. These manuscripts are fourteen in number. One of them, V, was used previously in the edition of Hercher, but is restudied here along with Westermann's manuscripts AB (formerly in the Vatican and now at Heidelberg). The remaining thirteen manuscripts were heretofore unstudied: Palatinus Graecus 134 (saec. XV) (X); Pius PP. II 42 (saec. XVI) (T); Reginenses Graeci 104 (saec. XV) (R), 138 (saec. XVI) (S); Urbinates Graeci 7 (saec. XV) (P), 132 (saec. XV) (Q); Vaticani Graeci 67 (saec. XIV) (F), 95 (saec. XV) (G), 1309 (saec. XIII) (H), 1353 (saec. XV) (I), 1354 (saec. XV) (J), 1461 (saec. XV) (K), 1534 (saec. XIV) (O).

A comparison of the letter order and the variant readings in these manuscripts discloses that they fall into two families: family a comprising VOBXGFKSPQ and family b comprising AHRJIT. Family a, in turn, falls into four subfamilies: V, O, BXGFK, and SPQ; family b into two: A and HRJIT.

In most instances where variations occur there is a sharp divergence between the readings of family a and family b, with the readings of both usually appearing equally correct. The problem of establishing the text, therefore, becomes one of determining which family is generally more accurate. Since the brief quotations from the letters in Plutarch's Brutus agree more closely with family a than with family b, a family is considered to be the better, and a preference is given to its readings.

In other instances variant readings are individually supported by a mixture of manuscripts from both families. These cases are usually the result of glosses in the original archetype, which, by a careful analysis of family relationships, can often be detected and eliminated from the text.

On the basis of the manuscripts here studied a total of 207 modifications in Hercher's text have been tentatively suggested. Most of these are entailed by the fact that Hercher favored the readings of family b in contrast to this author's preference for those of a. One hundred thirty of them represent a restoration of readings previously accepted in the edition of Westermann, who also preferred the readings of family a. It seems, therefore, that Westermann's edition, although based on fewer manuscripts, is superior to Hercher's both because of the former's greater accuracy in manuscript study and because of his better critical judgment.

It is foreseen that a critical examination of other unstudied manuscripts may invalidate some of the conclusions tentatively reached in this work. The author feels, however, that the basic structure of the interrelationship of the manuscripts and the major modifications necessary for the text of Hercher have already been reached in this study. Microfilm $2.40; Xerox $8.40. 182 pages.

A STUDY OF THE ARGUMENTS IN THE SPEECHES OF LYSIAS

(L. C. Card No. Mic 59-1517)

John Jay Bateman, Ph.D.
Cornell University, 1958

The purpose of this dissertation is to describe Lysias' arguments, to ascertain their sources, and to assess his contribution to the art of argumentation. The various kinds of arguments are isolated, analyzed, and classified. Their relationship to their immediate environment is then discussed.

Artistic proof is considered for the most part under the categories described by Aristotle and the Author of the Rhetorica ad Alexandrum. A distinction is made between formal and non-formal arguments according to the degree to which the argument depends on a prescribed form for its logical cogency. Formal arguments include antithesis and argument from opposites, hypothesis; and apagogic reduction. Underlying these arguments is the search for contradictions in the statements of the opponents or in the facts of the case. The content of the antitheses and arguments from opposites is the conduct of the parties to the case. Hypothetical arguments usually center on the facts under review, and aim at refuting the opponent's version or supporting the speaker's version of what took place. Non-formal arguments are probability, motive, time, consequence, definition, paradox, and comparison with its subclasses, analogy and example. The various types of these arguments are described, and their function in the pistis is analyzed. The most frequently employed kinds of non-formal argument are probability, consequence (which Lysias seems to have introduced into forensic oratory), and comparison. These three arguments along with antithesis and hypothesis form the basis of Lysias' argumentation.

The majority of Lysias' arguments are rooted in the intellectual background of fifth-century Sophism and rhetoric. In this element of his art Lysias is closely allied to theory, however much he tempers it with experience. The principal logical relations underlying his arguments

are contradiction, contrast, and comparison. His stock-in-trade is not very large. To obtain conviction he relies on his ability to find countless variations within these few arguments and on his subtlety in presenting them to his audience.

Non-artistic proof--witnesses, torture, oaths, and documents--provides corroborative evidence and material from which inferences about conduct can be drawn. Laws, however, may be the central subject of a construct. If the law favors his case, Lysias argues for strict adherence to its letter. If it is unfavorable or not wholly germane, he uses sophistic arguments on the intention of the lawgiver in order to support his case. There is no evidence that Lysias uses previously prepared proofs or topoi in handling this kind of proof except on the subject of torture.

Lysias disposes his arguments, especially those from consequences, in all parts of the speech. In the pistis, however, the arguments are arranged in constructs. The construct is a group of arguments, usually of different kinds, having a common purpose. Samples of different types of construct are analyzed. Elements common to all are extracted and discussed. The methods of connection and transition between arguments, and the frequencies of argument distribution in the construct are described. Lysias' disposition of arguments is compared to that of Andocides, Antiphon, Isocrates, the author of the Constitution of the Athenians, and the author of the speech for Polystratus (Pseudo-Lysias, Oration 20). It was found that the construct is the unit of composition in the argumentation as a whole, and that Lysias seems to have composed his constructs for a speech independently of one another and then fitted them into the speech.

Microfilm $2.55; Xerox $8.80. 194 pages.

THE LANGUAGE OF THE ROMAN MISSAL. PART III: SECOND SUNDAY AFTER EPIPHANY. TO QUINQUAGESIMA SUNDAY

(L. C. Card No. Mic 59-894)

Sister Florence Marie Gerdes, C.S.J., Ph.D.
St. Louis University, 1958

The Language of the Roman Missal: Part III is a study of the prayers of the propers of the Sunday Masses from the second Sunday after Epiphany to Quinquagesima Sunday, inclusively. Sister Magdalita Bruns, C.S.J., initiated the series with her study of the Advent Sunday Masses under the direction of the Reverend James A. Kleist, S.J., originator of the project. The Reverend J. L. White, S.S., continued with the Masses of the Christmas season in Part II. As in the two preceding studies of the series, this dissertation is divided into three sections: text and translation, grammatical commentary, and rhetorical commentary.

Text and punctuation of the Missale Romanum, as found in Sheed and Ward's The Missal, have been used. The self-translation was made with a view to fidelity to the Latin rather than to embellished English. For the reader's convenience the English translation faces the Latin text.

The grammatical commentary classifies the Latin words as Early Latin, up to Cicero; Classical Latin, from Cicero to the death of Augustus; Silver Latin, from the death of Augustus to Apuleius; Late Latin, from Apuleius on. Classical words used non-classically and ecclesiastical words are also indicated. Included in the grammatical commentary is a study of grammatical usage with particular interest in the frequency of non-classical constructions. Where the Greek serves as an enlightening factor, especially in the Epistles and Gospels, it is referred to. Interpretation of text as found in authorities like Britt, Boylan, Callan, and Knox, is added to give the work more meaning and fullness.

The rhetorical commentary lists the figures of rhetoric found in each prayer. The reader can determine at a glance the number and kinds of figures found in each prayer.

In addition to the three essential sections of the dissertation, there is an introduction, which discusses the place of Liturgical Latin within the framework of Latinity, the aims of this dissertation, and an explanation of procedure.

A summary follows the dissertation proper, listing the findings of this study. In brief, the results are as follows: of the five hundred and sixty-one words examined, two hundred and seventy are Classical; ninety-nine, Early Latin; ninety-two are classical words used non-classically; fifty are Silver Latin; twenty-nine, Late Latin; and twenty-one, Ecclesiastical.

The grammatical usages often follow a non-classical pattern: e.g., a quod clause commonly replaces the classical accusative-infinitive construction after verba sentiendi and declarandi; the avoidance of the classical ablative is notable; a non-classical use of the subjunctive is frequent.

The rhetorical commentary points out a greater frequency of rhetorical figures in the Old Testament selections which compose the Introits, Graduals, Tracts, and usually the Communions. Saint Paul's epistles evidence a swift, rhetorical style. The slower-paced Gospels are not lacking in figures of rhetoric. The collective prayers, by contrast, are effective with their terse, unfigured petitions.

A complete Index Verborum precedes the bibliography. The value of this will be realized when the series covering the entire liturgical year will have been completed.

Microfilm $5.30; Xerox $18.60. 415 pages.

LANGUAGE AND LITERATURE, LINGUISTICS

EINE SEMANTISCHE UNTERSUCHUNG DES GOTISCHEN UND ANDRER GERMANISCHER DIALEKTE IM SINNBEZIRK DES WILLENS

(L. C. Card No. Mic 59-1005)

Joseph P. Kowacic, Ph.D.
Bryn Mawr College, 1958

This is a semantic study of the words designating "will" in Gothic and other Germanic dialects. It attempts to interpret the pertinent passages in the Gothic Bible and also the passages corresponding to the Gothic ones in the Old High German Tatian, the Old Saxon Heliand, and in the West Saxon, Mercian, and Northumbrian texts of the Old

English Bible. The investigation deals in detail with the nouns, the adjectives, and the adverbs. As to the verbs, only those which are important for this investigation have been registered giving the meaning without quoting any passages.

By comparing the parallel passages in the different dialects, important clues to the dialectical distribution of the words designating "will" are obtained. In order to be in a position to judge the influence of the biblical language on the "original" meaning of the words designating "will", an attempt is made to ascertain this original meaning by comparing the meaning of individual words with the meaning of the other words of the word-family, using not only the expressions in the same dialect but also the etymologically related words of the other dialects, and of the other Indo-European languages, if these yield any pertinent information.

The work falls into four parts. Part One contains the meanings of the Gothic words from the Gothic Bible of Wilhelm Streitberg. The exact meanings of the Greek words of which the Gothic are a translation are drawn from the Greek-German Dictionary of Walter Bauer. A given Greek word often has a meaning not translated into Gothic. These meanings have been indicated in brackets. Similarly, should an entry occur in the Greek which does not occur in the incompletely preserved Gothic Bible, these entries too are indicated in brackets.

After a detailed treatment of the meanings of the words in the Gothic and the Greek, the pertinent passages are cited in all the languages mentioned above in paragraph one. In order to avoid needless and excessive length of treatment, it was considered necessary and sufficient to quote the German in full, thus providing context. The other languages and dialects are then cited as briefly as possible.

Part Two contains a detailed comparison of the entries and the expressions in which they occur in the various languages, together with a rather extensive etymological analysis of the more important word groups, and this on the basis of the Gothic.

Parts Three and Four are similar comparisons of the various entries on the basis of the Old High German and the Old English respectively. Since the comparison of the entries in Part Two is so comprehensive, and since a lengthier treatment in Parts Three and Four would necessarily result in much unnecessary repetition, these two Parts have been more restricted in scope.

A list of the words which have not been exhaustively treated has been appended at the end of the study, since such a list serves to delineate more exactly the limits of the word area studied.

Microfilm $3.50; Xerox $11.80. 270 pages.

LANGUAGE AND LITERATURE, MODERN

THE FUNCTION OF CLASSICAL RHETORIC IN SWIFT'S MAJOR IRONICAL ESSAYS

(L. C. Card No. Mic 59-850)

Charles Allen Beaumont, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor John M. Aden

This study is an exploration of how Swift uses non-argumentative devices of classical rhetoric to contribute to the creation of the irony of his major essays of ironic inversion ("A Modest Proposal," "An Argument against Abolishing Christianity," "The Defence of Lord Carteret," "The Answer to the Craftsman," and "A Proposal to Pay the Debt of the Nation").

From fourteen years of study in a basically classical rhetorical curriculum (slightly augmented by Ramism and Baconian induction) at Kilkenny School and Trinity College (Dublin), Swift gained a thorough knowledge of rhetoric as an art. His performance at Oxford, passages in his sermons, letters, essays, journal to Stella, and A Tale of a Tub further confirm this fact. Swift preferred the Plain Style and "reasonable" rhetoric for his sermons and non-ironical writing; in the ironical essays (which he characterized as grave formal lies) he used all the resources of rhetoric which suited his purpose.

I have analyzed each essay separately not only to demonstrate the functions of individual devices but also to discover the contribution of rhetoric to the creation of the whole ironic inversion. From the several degrees of pertinence which these devices have to the creation of the irony, one can distinguish three significant groups; those which actually create the irony and are thus integral to its very existence (ethical proof, amplification, diminution, and refining); those which, although not integral, contribute almost as substantially as does the first group (appeal to authority, elimination, argument from parallel example, and argument from wealth of sources); and those which help sustain the irony but which do not actually create it (litotes, direct emotional appeal, interrogation, rhetorical question, personification, climax, anticlimax, and accumulation).

Following Aristotle's emphasis on the character of the pleader as the ethical proof, Swift uses ethical proof as the basic, sustaining, and unifying device of classical rhetoric in all of these essays. His "authors" are rather fully developed characters who reveal their reasonableness, clarity, astuteness, concession, deference, fairness, and patriotic motives. Irony requires a pose, which Swift creates largely by ethical proof. The point of view of the "author" thus is the first step in the creation of the ironic pose. Diminution, amplification, and refining must stem from a value-system and judgment; thus, their reflecting this value-system further indicates, expands, and sustains the ironic norm. Swift never, however, allows himself to become slavish to his "author." In some of the most powerful passages Swift drops the pose and speaks in his own person. These break-throughs heighten the rhetorical effect because they are calculated strokes, not personal indignation. Swift's constantly varying the degree of irony by the degree of his own presence adds fascinating

dimension to his ironic satire and keeps the ethical proof from ever becoming cumbersome.

Through elimination Swift brushes aside all other possibilities, thus casting over his proposals an aura of uniqueness. Through argument from a wealth of material he creates the illusion that he is dealing only with salient material and that many lesser arguments can also be found. Through parallel example and appeal to authority (especially the authority of the whole nation) Swift manages to imply that the ironic inversion rests not just on the material within the essay but that situations and persons outside the inversion also substantiate the ironic norm.

These major devices combine with the supplementary devices (group three above) to create and sustain the ironic inversions of these essays, which simply would not exist in their present form without this classical rhetoric.

Microfilm $4.45; Xerox $15.00. 347 pages.

WILLIAM HARRISON AINSWORTH: HIS ARTISTRY AND SIGNIFICANCE

(L. C. Card No. Mic 58-5114)

Jack I. Biles, Ph.D.
Emory University, 1954

In the late 1830's and early 1840's, William Harrison Ainsworth was the most popular novelist in England. Gradually, Charles Dickens surpassed him in public favor, and his decline into the oblivion of literary minority has continued unabated. The matchless popularity of Ainsworth in 1840 and the great neglect of him a century later are intriguing to the student of the novel.

This study assumes that the enduring qualities of fiction stem from the literary artistry with which the works are made. The primary problem, therefore, is to examine critically the more than forty novels of Ainsworth with a view toward evaluating them as examples of the art of the novel. Secondarily, the aim is to infer from the critical analysis possible reasons why Ainsworth has not retained his popularity.

The approach to the general problem of analysis and criticism is to subdivide literary artistry rather arbitrarily into five components and to apply commonly accepted standards to each of the factors in turn. The elements of literary artistry here examined are the techniques of narration, style, description, characterization, and construction.

In his narration, Ainsworth is exceedingly self-conscious and digressive, but he is very facile. He begins precipitately, keeps his eye upon action, and pens enthusiastic but frequently shrill narrative. His dialogue is stiff and composed of elegant Victorian rhetoric. Like some of his other narrative elements, his dialogue shows the influence of the Gothic in its exaggerated, exclamatory, melodramatic, and unreal qualities. Despite his digressiveness and the oratorical quality of his narration, Ainsworth does maintain a breakneck pace. For all his many technical insufficiencies, he succeeds in writing vivid and exciting and, sometimes, exceptionally graphic narratives.

Ainsworth's style is rhetorical and typical of the false elegance of the "refined" and sentimental fashionable novels of the Victorian age. The modern reader of popular fiction will find the style tediously cumbersome, but the reader accustomed to eighteenth- and nineteenth-century fiction will find it less objectionable. Indeed, Ainsworth's style, despite its deficiencies, is relatively suitable for the purpose and equal to the demands made upon it. At least, the reader soon ceases to be disturbed by it.

Ainsworth writes many, frequently long, descriptions of settings and characters, and he applies garish colors with a liberal hand. From the attention paid to detail, Ainsworth's descriptions might be more realistic than they are; but his verbosity and his fondness for the lurid and the showily attractive create scenes that are gorgeous and pictorial, but less convincing than they would otherwise be.

As a portrayer of human character Ainsworth is indisputably a minor author. His customary method of characterization is to describe, not to demonstrate through dialogue and action. Ordinarily, his persons are stock figures and too extreme to be plausible. From time to time, however, he does present a momentarily convincing characterization, but never a penetrating analysis. He is most competent with caricatured or semi-caricatured figures, and with them occasionally he is surprisingly effective.

As a structural artist Ainsworth leaves much to be desired. His action nearly always is independent of character, although there sometimes is weak motivation. There is an overwhelming tendency toward melodrama in Ainsworth, and, while he often integrates the sensational elements into the story, he is prone to indulge in sensation for its own sake. Failure to motivate action, digressiveness, authorial intrusion, excessive self-consciousness, lack of preparation for the things that happen, overuse of coincidence, faulty linking of story with background and characters, severe problems of plot resolution--these flaws are characteristic. The interest and readability which Ainsworth somehow still has must stem from the absorbing nature of desperate action.

Ainsworth has no such significance as Scott has for the twentieth century. Ainsworth has little importance in the development of the novel, for he added nothing to its artistry. His romances have comparatively little overall verisimilitude; they are pretty tableaux, not rejuvenations of the past.

Of the five artistic elements considered, it seems fair to say that Ainsworth succeeds with three of them and fails with two. His narration is lively and exciting, his style is generally adequate, and his descriptions are sometimes very successful. It cannot be said that he is competent in characterization and construction. It is claimed here that characterization is an especially significant part of fiction, and it has been demonstrated that Ainsworth's is weak. Construction is asserted to be a most significant artistic element, and it has been shown that structure is, to all intents and purposes, non-existent in Ainsworth. Thus, the decline of Ainsworth as a literary figure stems from his inadequacy in two most important particulars of novelcraft.

Despite his shortcomings, there is something to be said for him. Although he is primarily a romancer of sensation, violence, and melodrama, Ainsworth's stories are excellent of their kind. His romances have some value as a pleasant source of information about dramatic moments in history. He has a readability which is rather difficult to explain, beyond its origin in desperate and thrilling action.

Like the works of most minor writers who have been virtually forgotten, Ainsworth's romances are not likely to have any substantial revival. At the same time, the current re-issue of four of his titles indicates that interest

in Ainsworth has not entirely passed. Moreover, scholars may return to him for study because of his many connections with and possible influence upon Dickens, Thackeray, Bulwer, and others. Further, his work warrants study because of its fusion of Scott's historical romancing and the major elements of Gothicism. Finally, the vast success of Ainsworth in his own day makes his work of value as representative of English popular taste in the nineteenth century. Microfilm $2.25; Xerox $7.80. 169 pages.

UNTERSUCHUNGEN ZU HOFMANNSTHALS "WEG" DER LUSTSPIELE

(L. C. Card No. Mic 59-1190)

Victor Richard Block, Ph.D.
Cornell University, 1958

Supervisor: Professor Erich Kahler

Idee und Titel dieser Arbeit erwuchsen aus zwei Äußerungen Hofmannsthals. An seinen Verleger schrieb er einmal, er würde so sehr gerne den Band "Lustspiele" hergestellt sehen, der einen Weg, den er gehe und bis ans Ende gehen werde, deutlich aufzeige und er könne nicht anders denken als daß dieser Band, selbst einzeln, Freunde finden würde, ganz besondere Freunde und in dem Dokument Ad me ipsum -- ein Versuch einer Selbsterklärung und Selbstdarstellung -- findet sich die Eintragung: "Das erreichte Soziale: die Komödien."

Hofmannsthal empfand also seine Komödien als etwas Spezifisches, das sich von seinem übrigen Werk abhebt und sie weisen alle auf ein Gemeinsames -- das "Soziale" -- hin. Gestützt auf das Ad me ipsum wird versucht diesen "Weg" und seine wichtigeren Stationen zu bestimmen und zu erschließen, was der Dichter mit dem "Sozialen" meinte.

Dabei zeigt sich, daß nicht Thematik sondern eine bestimmte Geisteshaltung den "Weg" ausmacht. Hofmannsthals Briefe zeigen deutlich, daß er bewußt Neues unternimmt und es konsequent auszugestalten sucht. Der große Impuls der Sommer 1907/8, von denen an er seine "eigentliche Theaterschriftstellerei" datiert, speist alle Komödien bis über den Schwierigen hinaus.

Dieser Wendung zum wahren Theater -- es "postuliert jeden, der sich mit ihm einläßt, als gesellige Person" -- liegt Hofmannsthals Anliegen zugrunde zum Leben durchzustoßen; die Besinnung auf sein österreichisches Erbe, insbesondere auf die Wiener Theatertradition, trägt dazu bei. In allen Komödien wird das heimische Element sehr stark, der Schauplatz Österreich, oder, wie in Cristinas Heimreise, ein sehr österreichisches Venedig; österreichisch auch das Idiom: charakteristische Sprache oder eine für einen gewissen Stand und eine bestimmte Zeit symbolische, wie im Rosenkavalier. Die Figuren sind, auch wo sie traditionelle Theatertypen vertreten, durchaus individuell gezeichnet; sie bewegen sich in einem dreidimensionalen Raum und zeigen alle Abstufungen der reich ständisch gegliederten Gesellschaft Alt-Österreichs.

Diese gegliederte Gesellschaft bietet das ideale Material für die Darstellung geselliger Anliegen; die Sozialen Bezüge sind nicht nur horizontal sondern auch vertikal gestaltet: Standesmischung bildet ein wichtiges Element.

Da das Individuum in ein "tausendfach verhäkeltes Verhältnis" zur Welt gesetzt ist, ergibt sich für Hofmannsthal die Notwendigkeit, diese Bezüge in Komödien zu behandeln, denn nur die "wirkliche Komödie" setzt ihre Individuen in solch ein Verhältnis zur Welt, nur sie "setzt alles in ein Verhältnis zu allem und damit alles in ein Verhältnis der Ironie." Damit ergibt sich die Ironie als das wichtigste Element der Hofmannsthalschen Komödien; sie ist ein Korrelat des Geselligen und ihr In-Beziehungsetzen von allem läßt die latenten Widersprüche aufscheinen und stellt die geltenden Wertsysteme in Frage.

Die Konzeption der Komödien ist "undialektisch"; da Hofmannsthal "das Bild der Welt nicht aus Bruch, Kampf, Dualismus wachsen" läßt, wird in seinen Stücken "nicht etwas auf einer dritten Stufe nach Satz und Gegensatz, erreicht -- sondern es tritt etwas heraus, es enthüllt sich etwas."

Dementsprechend wählt er seine Hilfsmittel, das "Wesentliche", das "Metaphysische" zu enthüllen: die Sprache ist nicht die eigentliche Trägerin der Mitteilung -- er dichtet sozusagen gegen sie -- er versucht durch Indirektes, "Mimisches", durch alles was dazu dienen kann, aus der Mitte heraus, aus der Gestalt das Wesen, die Dinge sich selbst aussprechen zu lassen.

Die Sprache ist unzulänglich als Mitteilungsmittel aber das Individuum ist durch sie "ob es will oder nicht" "rettungslos" mit der Gesellschaft verknüpft. Wegen ihrer Unzulänglichkeit muß sie zu Mißverständnissen führen, so wie sie auch ver-führt zum Sprechen, zu einem "Zu-viel im Reden" und auch zur Lüge. Mißverständnisse, Übertreibungen, Lüge -- Intrige -- sind traditionelle Elemente der Komödie, bei Hofmannsthal aber vertieft durch Einblick in die existentielle Situation des Menschen.

Diese Situation aber im Lustspiel zu gestalten -- weil vom Geselligen her gesehen -- zu ihr also leicht "ja" zu sagen: "So hat halt Gott die Welt geschaffen / und anders hat ers halt nicht können machen," dies ist österreichisch, undialektisch wie die Musik Mozarts.

Microfilm $3.40; Xerox $11.60. 262 pages.

MIGUEL DE UNAMUNO'S 'EL CRISTO DE VELÁZQUEZ'

(L. C. Card No. Mic 59-1080)

William Calvin Cannon, Ph.D.
Tulane University, 1958

Chairman: Concha Zardoya

In Spanish literary criticism Miguel de Unamuno has been known primarily as the author of essays, short stories, and novels. Unamuno was proud of his prose works and talked of them often. But these to him were of secondary importance in the broad range of his creative activity, for his life's high calling was to be a poet. Of his many volumes of poetry, the one which received his greatest devotion and care, and the one which has been considered by the body of modern Spanish poets and critics as Unamuno's masterpiece, is El Cristo de Velázquez. The present study is an examination of the poem on four levels: the theological tradition, the mystic experience, the symbolic expression, and the formal achievement.

The organizing tradition of El Cristo de Velázquez is

the tradition of the Bible, and particularly of the Fourth Gospel. From this Gospel Unamuno took the poem's primary themes: Christ as light, logos, and love; and the secondary ones: Christ as Truth, Man, Son of Man, and Humanity. The single non-Johannine doctrine is Recapitulation, derived primarily from Paul but harmonized with the Fourth Gospel's theology of the Son of Man.

The impressive spiritual qualities that pervade El Cristo de Velázquez have led many readers to speak of it as a mystic work. The poem's mysticism derives from its Johannine theology, and is remarkably close to the Christ-mysticism of the primitive Church: finite and infinite, temporal and eternal, earthly and heavenly, corporal and spiritual. Over the length of the work, binding the various parts together in essential unity, there is projected an informing light mysticism. Within the frame of Christ and light mysticism, there is the mysticism of sacrament and the mysticism of pantheism. The latter is intensified through the cosmic, alchemical and Orphic dimensions of the body of the Crucified Christ. This mystic pantheism points to a final recapitulation in God, an eschatological God-mysticism to supersede the Christ-mysticism of the here and now. Finally, the mysticism of the poem is grounded in the love of Christ who in self-immolation fully revealed not only his love for man, but also the divine scheme of purpose and being.

The mysticism of El Cristo de Velázquez is also affirmative, accepting names and symbols as effective means of mystic union. The poem's use of symbolism in general and of the names of Christ in particular, is perhaps the most copius in the whole of Spanish literature. The vast majority of them belong to the Christian tradition and may be easily found in the Bible, the patristic writings, and in the mystic and devotional literature of Christianity. Three fundamental symbols, however, stand apart from this tradition and must be interpreted mythically in order to appreciate their full value in the poem: the moon as Christ, the sun as God, and the mother earth as the Virgin.

Finally, El Cristo de Velázquez is studied as a lyrical poem of unusual musical power. It has the impetus, the drive, and the continuity of music, and employs many of the techniques of music (insofar as musical techniques can be employed in poetry). Rhythm (determined largely by the high proportion of medial stops), leitmotiv, and anaphora are the primary formal characteristics of the poem. Each suggests musical parallels. Tone and nuance are provided by alliteration, assonance, rhyme, expressive and imitative sounds, and occasional stresses of purposeful dissonance. The skilful orchestration of these many elements constitutes the musical achievement of El Cristo de Velázquez.

Two appendices include significant notes by Unamuno found in the manuscripts of the poem, and a short discussion of the principal editions of the poem.

Microfilm $2.65; Xerox $9.20. 201 pages.

AMERICAN NOVELS ABOUT ADOLESCENCE, 1917-1953

(L. C. Card No. Mic 59-1088)

Helen White Childers, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: William J. Griffin

This investigation of American novels about adolescence written between 1917 and 1953 is based on an annotated, chronologically arranged check list which appears in the appendix. The check list includes only novels written for adults and dealing significantly with characters between the ages of eleven and twenty-one. Within the text, one intention has been to describe general patterns into which the novels fall and to determine how they fit into the literary framework of the time when they were written. A limited number of novels of literary merit, representing various kinds of literary attack, are selected for special analysis to discover the aspects of adolescence that have interested the authors, attitudes toward adolescence that have been taken, techniques that have been used, and differences between earlier and later treatments. In selecting novels for special analysis, consideration was given to opinions of reviewers and critics, but some reliance was also placed on personal judgment. A background study of older novels about adolescence furnishes a frame of reference for the discussion.

The four large groups into which the novels fall are: adolescent life histories ending in more or less successful initiation into adulthood, in which works depicting the artist as adolescent constitute a subdivision; sociological studies portraying victims of social forces; psychological studies of adolescents who fail in the initiation; novels in which the adolescent is a technical device. Minor types are episodic reminiscences, "formula novels," and idylls.

Scores of authors have treated characters in all stages of adolescence with seriousness, sympathy, insight, and skill. Fresh psychological approaches to adolescent problems have been made, and many novelists have handled the subject with new frankness. Use of psychoanalytical material, incorporated with increasing skill, has steadily broadened and deepened. The meaning of many recent novels depends upon manipulation of psychoanalytical metaphors. The tendency has been toward deeper exploration of shadowy and unusual aspects of adolescence, limitation of subject matter, and concentration upon phenomena particularly relevant to adolescence.

The earlier broadly based realistic or naturalistic novels depicted the adolescent's period of discovery. Treating adolescents as particular individuals, they recounted their struggles in the broad social world of adults. They stressed the later years, and usually ended with the character's maturity. In the carefully structured, limited, symbolic novels now favored by critics, the adolescent, often a very young symbolic character, is used as a technical device enabling the author to convey an intense impression of the nature of maturity. The novels are concerned with the timeless and universal, with innocence and the meaning of its loss. The best recent works are descendants of the novel about adolescence exemplified by James, Anderson, Cather, and Faulkner.

By the early forties, most subjects and themes had been defined or indicated, and the adolescent had been used

as a technical device in most of the ways he has since been used. Changes in subject matter and themes lie in emphasis placed upon them and in deeper or better ordered explorations; techniques have been refined and adapted. Authors have found in the adolescent, because of his nature and the advantages he offers as a method of control, an increasingly useful means of presenting their vision. The pathetic adolescent, whose fictional representation in each decade has undergone changes reflecting the nature of the times, has been an arresting and appropriate figure in the literature of a nation in a period of transition, during a time of world-wide unrest and violent, rapid change.

Microfilm $5.45; Xerox $19.20. 426 pages.

WORDSWORTH'S STYLE AND VERSIFICATION IN THE PRELUDE

(L. C. Card No. Mic 58-5123)

Thomas David Cobb, Ph.D.
Emory University, 1954

There has long been a tendency among scholars to neglect the craftsmanship of William Wordsworth. In the study of a poem like The Prelude, for example, it is natural that the meaning, the poet's views of nature, man, and God, should be emphasized. But Wordsworth's style and versification in this poem deserve a critical attention they have not thus far received. Early in Wordsworth's career, Francis Jeffrey in his slashing attacks on the poet in The Edinburgh Review denied him any skill as a craftsman. Other critics, like George Saintsbury, have confirmed Jeffrey's judgment, even though otherwise they have not been swayed by Jeffrey's prejudice. Nevertheless, there is overwhelming evidence that Wordsworth was a sincere and dedicated artist, diligent and successful in his attention to the techniques of composition and the details of revision. The problem, therefore, is to determine whether the style and versification of The Prelude disprove the indictment returned by critics like Jeffrey and Saintsbury, justifying a new emphasis upon Wordsworth's technical artistry.

Although The Prelude is not a model of objective architectonics, its general structure, an aspect of its style, has integrity of form and is obedient to artistic law. Analysis demonstrates that, structurally, the poem is not strictly autobiographical. Instead, it is highly selective, emphasizing the forces—scenes, incidents, people, and mental experiences—which fostered certain traits in the poet and promoted the growth of his imagination, the theme and the controlling element in the architecture of this work. The subdivisions, or books, of the poem exhibit further the ability to shape the larger structural elements. Book I, for example, represents not only a skillful integration of apparently disparate parts but also a miniature of the structure of the entire work of art; and Book VIII demonstrates the poet's structural virtuosity, summarizing all that has gone before in such a manner as to supply the only adequate preparation for what is to follow.

With the smaller structural elements Wordsworth is equally successful. The sweep of his verse paragraphs is typically represented by three basic methods of organization: the expansion of a broad generalization by means of specific examples or details, often arranged climactically; the employment of contrasts and comparisons, sometimes developed into poetic analogies; and the exposition of the processes, especially mental processes, by which his growing mind moves from phase to phase. Although in some paragraphs there are idiosyncrasies or occasional weaknesses, a close examination shows most of the former to be artistically sound and effective, few of the latter to be typical of the main body of the work. Sentences are not so long as they look, semicolons and colons often serving where a modern poet would use periods. Seldom does balanced or periodic structure overflow a sentence, normally influencing only one of its parts. Most sentences are loose, not often complicated by Latinic inversions, nominative absolutes, or involved parallelisms. Repetition is used with restraint but with telling impact; nouns and adjectives on occasion are piled high; but it is usually the verbs that bring the poetry to life. Despite the two dozen or so syntactical errors in the thousands of lines, Wordsworth's sins are venial: they seldom recur, and are outweighed by a customary purity of syntax and by an unobtrusiveness of sentence structure that seldom seems contrived. As nature's voice, Wordsworth is nearly always in tune.

In no other poem does Wordsworth impart to his diction the cumulative connotations found in the language of The Prelude. Whether coined or borrowed, his words illumine the mazes of human thought and reveal how nature works "like a sea" upon the growing imagination. By means of prefixes (e.g., under-, circum-, inter-) Wordsworth probes the mind; words like Being and sense he subjects to an alchemy of his own formulation, growing out of his reaction to experience. Though on occasion he can marshal highly specific words, he is usually too universal in his purpose to favor the local and the particular. Latinic mannerisms and pompous phrases sometimes mar his diction, but in general his vocabulary leans toward Anglo-Saxon simplicity and Biblical dignity. Rather often he borrows from one of his own earlier poems or draws upon the treasuries inherited from the elder poets. When he borrows words, however, he assimilates them into a common denominator distinctively Wordsworthian, an individual voice and tone, and a texture stamped with his own die. If his voice falters momentarily towards the end of the poem, the alien note is not intrusive and is soon forgotten, though it presages the tone of the older Wordsworth.

By casting over the naturalistic the "auxiliar light" from his own mind, Wordsworth in The Prelude evokes the infinite from the commonplace, makes realistic details dynamic, renders the factual sublime, so fusing the earthy with the imaginative as to produce a prevailing style that may be defined as romantic-realism. Though his subject matter ranges from love to war, from politics to philosophy, from external phenomena to human nature, from the simplicities of childhood to the complexities of adult life, this pervasive style invests the entire poem. On the surface some passages appear pure, or classical, or romantic, or starkly realistic. But analysis indicates that romantic-realism ultimately informs them all, operating with equal power upon sense-impressions of touch, sound, and sight. If the storm seems darker in the presence of the poet's eye, it is because his style is as creative as it is receptive, imparting wonder to what would be ordinary to another.

The general prosodic characteristics of the blank verse of The Prelude suggest strong individuality within flexible traditional norms. Only about 22% of the lines are "regular"

iambic pentameter, but most of Wordsworth's variety is achieved within the usual ten syllables. Extra syllables, when they do occur, grow out of trisyllabic feet and redundant endings; extra accents, out of numerous spondees. The latter are often balanced or pyramided by pyrrhics and varied by trochees, each supplying variations with a purpose. There is no tendency toward the Alexandrine or toward unrhymed couplets, enjambment prevailing. Mid-stops equal end-stops, and the appropriate use of masculine and feminine caesuras, ranging through the positions, makes the lines metrically adaptable to a multitude of effects.

Going beyond such mechanical skill, Wordsworth fits sound to sense, employing monosyllables to slow the pace or to achieve the oracular line, using alliteration (though not always happily) to promote secondary rhythms, to simulate the sound of skates on ice, or the roar of torrents heard in the Simplon Pass. He can startle with initial trochees, gain emphasis with spondaic feet, combine an anapest with a pause to focus lingering attention, produce overtones of sound with assonance and consonance, unify with phonetic syzygy, and underscore changing moods and shifting actions by means of infinitely varied caesuras. Using all the resources of onomatopoeia, vowel music, and connotative diction, he supports meaning with sound, employing with equal skill flowing liquids and harsh gutterals, adapting them to his artistic purposes.

In making revisions of The Prelude Wordsworth was a conscientious and highly successful craftsman. The fact that he delayed the changes until late in life carries little significance: in youth, as in age, he always scrupulously readied a poem for the press. If he found that in a given instance he could not favor both prosody and other aspects of style, he normally gave versification less emphasis than diction, phrasing, tone, and texture. But in the main he was able by revision to improve all the technical elements of the poem, though occasional flaws result from the alterations. Whether or not the late revisions may be criticized as somewhat emasculating the content of The Prelude, their contributions to its technical excellence are notably fortunate.

The evidence of Wordsworth's artistry in his greatest work not only proves that Jeffrey and Saintsbury were wrong in stigmatizing the poet's craftsmanship, but also calls for greater attention on the part of scholars to the skills employed to convey the epic values of The Prelude. To stress the artistry as well as the meaning of the poem should enable students to improve their taste and to quicken their ability to comprehend wellings from the deepest abysses of human experience. A careful critical analysis of The Prelude will reveal that the poet's craftsmanship was not inferior to the character of his thought and feeling.

Microfilm $3.10; Xerox $10.60. 238 pages.

THOMAS DIXON: HIS BOOKS AND HIS CAREER

(L. C. Card No. Mic 58-5125)

Raymond Allen Cook, Ph.D.
Emory University, 1953

Thomas Dixon (1864-1946) was one of the most colorful and versatile figures of his generation. Lawyer, minister, lecturer, novelist, playwright, motion picture producer, and politician, he rose to fame and wealth during the first two decades of the twentieth century, only to lose much of the fame and all of the wealth which had made his name known to millions of people. Dixon was a prolific and highly successful novelist who depicted the Reconstruction troubles of the South in general, and of the Carolinas in particular. He was the first author to make widely popular a fiction which treated the Reconstruction period strictly from the Southern viewpoint. Of Dixon's score of novels, more than five million copies were sold; of these novels, The Leopard's Spots and The Clansman are the best known. From the latter novel was made "The Birth of a Nation," one of the great landmarks in motion picture history.

No published biography or critical study of Thomas Dixon exists at the present time. One of the purposes of the investigation, therefore, was to obtain pertinent biographical data concerning the man. A more important purpose of the investigation was to study the career of Dixon in the frame of his time and the forces which stimulated him. The details of Dixon's life were assembled by searching among newspaper files, interviewing friends and relatives of the man, studying letters, contracts, deeds, court records, magazine articles, and various manuscript sources.

Dixon was born in Cleveland County, North Carolina, January 11, 1864. After receiving his Master of Arts degree at Wake Forest College at nineteen years of age, he proceeded to The Johns Hopkins University where he took a special course in history and politics. While at Johns Hopkins, he became the close friend of his classmate Woodrow Wilson; later Dixon was responsible for Wilson's receiving his first honorary degree.

Dixon was elected to the General Assembly of North Carolina before he was old enough to vote; there he introduced the first pension bill in the South for Confederate veterans. Upon completion of a law course at Greensboro, North Carolina, he was admitted to the bar in 1886, and he participated in two famous trials at the age of twenty-two.

In 1886 Dixon married Harriet Bussey, and later in the year he turned from law to the ministry. After filling pastorates in Goldsboro and Raleigh, North Carolina, he went north and soon became widely known as a minister in Boston and New York. So popular were his sermons that no halls could be found large enough to accommodate his congregations. Subsequently he became one of the most popular platform lecturers in the country, and his appearances in various cities received wide notice.

The desire to reach a still larger audience than he could by lecturing prompted Dixon finally to turn, at the age of thirty-eight, to the writing of novels. It was through this medium that he achieved his greatest fame. Dixon's first novel was The Leopard's Spots (1902), a story of the trying conditions in the South immediately following the Civil War. The scene is the Piedmont section of North Carolina, and many historical figures are thinly veiled as characters in the book. Seldom has a first novel been so violently criticized, praised, and widely read. Within a short time several hundred thousand copies were sold; so great was the sensation produced by the book that numerous editions were printed in the European tongues, and the author's fame became international.

Dixon wrote novels treating nearly every important social issue of his day, including treatments of racialism, Southern history, socialism, communism, and woman

suffrage. His novels dealing with the racial problem include The Leopard's Spots, The Clansman (1905), The Traitor (1907), Sins of the Father (1912), and The Black Hood (1924). Historical novels treating famous men involved in the Civil War include The Victim (Jefferson Davis) (1914), The Man in Gray (Robert E. Lee) (1921), and The Southerner (Abraham Lincoln) (1913). Dixon's novels on socialism are The One Woman (1903), Comrades (1909), The Fall of a Nation (1916), and Companions (1931). His works which treat the matter of woman suffrage are The Way of a Man (1919), The Love Complex (1925), The Foolish Virgin (1915), and The One Woman, which also has a denunciation of socialism for its thesis.

Dixon's last novel, The Flaming Sword, published in 1939, is an intense and almost prophetic work pointing up the imminent dangers of communism to America. Besides the novels mentioned, Dixon wrote a number of other works dealing with various subjects. In addition to these books, Dixon wrote and acted in several successful palys.

Although Dixon produced several motion pictures, they were overshadowed by "The Birth of a Nation," which was adapted from The Clansman and produced by D. W. Griffith in 1915. So popular was this motion picture that it broke all attendance records. "The Birth of a Nation" was first shown privately to the President of the United States and his Cabinet, to the Supreme Court, and to both houses of Congress, a distinction not held by any other motion picture.

Dixon's contributions to the development of the motion picture industry have generally been overlooked. As early as 1913 he had tried to produce The Clansman in color, and at his own studios in Hollywood, later bought by Twentieth-Century Fox, he experimented with various techniques and story types. Throughout the nineteen-twenties and thirties he was one of the industry's most articulate supporters for improving the artistic and moral qualities of motion pictures.

The great wealth which came to Dixon as a result of his literary labors enabled him to own several fine homes in New York City, and Elmington Manor, a thirty-seven room mansion on Chesapeake Bay. But by his own admission, he was nearly penniless in 1934, having lost most of his wealth in stock market crashes and real estate ventures. After the death of his first wife in 1937, Dixon moved to Raleigh, North Carolina, where he married Madelyn Donovan in 1939. There he remained until his death on April 3, 1946.

Whether or not Thomas Dixon will remain a significant figure in American literature is a question not lightly to be dismissed. The literary quality of his novels is evidently that of popular works that fade in importance as each new generation acquires new tastes. The sociological significance of his works, however, will no doubt be evident for decades to come. The present age still reckons with the racial problems which Dixon discussed in his novels; the motion picture with its offspring, television, will no doubt continue to be a tremendous force in society; and the world looks apprehensively to the future power of communism which Dixon decried so vehemently in his fiction. Many people were brought by Dixon's works to think seriously about these matters which he thought were of vital importance to the nation. In his own way, which was at times reactionary and biased yet always devoted to what he held as right, he served his era in a quest for better standards and ideals. His zest for life, his enthusiasm for accomplishment and his versatile career should make him of continuing interest to students of American literary history. Microfilm $3.20; Xerox $11.00. 247 pages.

ZUR BEDEUTUNG WICHTIGER WÖRTER IN DEN FRÜHEN SCHRIFTEN VON RILKE. (VOLUMES I AND II.) [THE MEANING OF SOME SIGNIFICANT WORDS IN THE EARLY WRITINGS OF RILKE]

(L. C. Card No. Mic 59-1001)

Mary B. Corcoran, Ph.D.
Bryn Mawr College, 1958

This study attempts to determine the meaning of the words "Rand", "Saum", "Grenze", "Mark", "Mauer", "Brücke", "Übergang", "Abgrund", "fallen" and "Baum" in those writings of Rilke which were completed before September, 1902 when he came under the influence of Rodin. Every appearance of the individual word, even its most common usage in letters and diaries, is taken into consideration so that it may be better understood how the word became an important image or symbol in the language of the poet. The words are investigated not merely from the point of view of their significance within their immediate context but also in the light of any other writings written around the same time, if such further material seems to give insight into the meaning of the words themselves.

Since it was felt that a word study of Rilke must be approached chronologically a chronological bibliography of all of his German writings covering the period 1892 to 1902 was compiled. The dating of the writings established in the bibliography served as a basis on which the dictionary of the ten words of the study was arranged. The frequency of usage and the diversity of meaning of the words can be seen from the dictionary in which all references are given for the appearance of the words in any form of writing whatsoever. Only the passages are quoted in which the meaning of the word is both significant to some degree and can be determined from its immediate surroundings. Occasionally a word that does not seem to bear any particular weight in its context assumes importance because of its frequent appearance in similar connections.

Much of the material contained in the dictionary is analyzed in detail in the body of the thesis. Since the words chosen for the study are interrelated they are treated either individually or together according to the main spheres of experience that they express. The first section of the thesis discusses Rilke's fear of life as it is revealed in the words "Rand", "Mauer" and "Abgrund". His frequent use of the word "Rand" in the year 1898 in Italy indicates that he greatly fears the loneliness and responsibility of his mission in life as a prophet of a new era in art. On the basis of the usage of the word "Mauer" between the years 1896 and 1901 it is evident that Rilke suffers under the feeling that his own age imprisons the artist and prevents him from developing his full powers. The nouns "Rand" and "Abgrund" as well as the verb "fallen" as they occur in the years 1897 to 1899 prove to be expressions of Rilke's inherent fear of love, both as a fear of being separated from the loved one and as a fear

of losing one's own identity by submitting to love. The second section of the thesis treats the poet's fear of death and transitoriness. The words "Übergang", "Rand" and "fallen" indicate that Rilke often suffers from the sense that his past no longer has any relationship to him. He thus fears the lack of reality of his present existence which can only become real if his past experiences are regained in poetry. The third section of the thesis discusses Rilke's early attempts to overcome his fear of life and death by returning to himself and his childhood. The words "Mauer", "Grenze", "Rand", "Mark" and "Abgrund" together with the symbols of the garden, the summer, the circle and the tree show that the poet finds in the concept of protection and spaciousness within boundaries a fortress against the main source of his fears, namely time.

Microfilm $6.30; Xerox $21.80. 494 pages.

E. M. FORSTER, AN HISTORICAL AND CRITICAL STUDY

(L. C. Card No. Mic 58-7835)

Frederick C. Crews, Ph.D.
Princeton University, 1958

This study represents a systematic effort to set forth the dominant beliefs and loyalties of E. M. Forster; to place those beliefs and loyalties in an historical perspective, by outlining the nineteenth-century traditions to which they belong; and, finally, to bring this knowledge to bear upon a critical examination of Forster's longer works of fiction.

Accepting as a premise Forster's statement that his ideas are typical of "the fag-end of Victorian liberalism," the dissertation begins by juxtaposing several conflicting definitions of the liberal tradition. It is argued that nineteenth-century liberalism as Forster understands it is a highly complicated and often self-contradictory phenomenon. A broad account is given of the interweaving of the various strands of Constitutional liberalism, Utilitarianism, and collectivism in nineteenth-century English politics. Special emphasis is placed upon the careers of John Stuart Mill and W. E. Gladstone, with a view toward indicating the increasingly intimate relationship between individualism and collectivism. The structure and the decline of the Liberal Party are likewise traced, in order to show the disparity between Gladstonian liberal ideals and the actual policies of the Liberal Party at the close of the century. By 1903, the year of the founding of the Independent Review, many of the "Victorian liberals" in Forster's sense of the term were without a party; and the Independent Review itself, which Forster admired unreservedly and to which he submitted a good many of his earliest tales and essays, was intended as a sounding-board for precisely this group of disinherited liberals. Forster's own attitude toward politics and his opinion as to the importance of art are shown to concur with the views of several other contributors to the Independent Review.

With this general orientation, the specific sources of Forster's ideas are next examined. Forster's sense of his intellectual and family background is reconstructed from a study of his biographies, Goldsworthy Lowes Dickinson and Marianne Thornton, and of his essays in Abinger Harvest and Two Cheers for Democracy. The ideas of Forster's Evangelical ancestors in the Clapham Sect are contrasted with Forster's own agnosticism; and particular attention is drawn to the views of Leslie Stephen, who serves as a transitional figure between the pietism of Clapham and the relaxed agnosticism of the Bloomsbury group. The differences in outlook between Stephen and Forster are emphasized, as are the common values that both men derived from their exposure to the traditionally liberal atmosphere of Cambridge. An attempt is made to relate Forster's beliefs to those of his teachers and friends at King's College, the most influential of whom was G. Lowes Dickinson.

The remainder of the dissertation is given over to a critical study of the five published novels. The thematic issues and resolution of each novel are discussed in relation to Forster's total philosophy as it has been set forth in the previous chapters. Forster's symbolism, his use of Greek mythology, and his sense of comedy are examined in turn, with the double aim of showing his derivation of literary ideas from other authors and of demonstrating how Forster's own outlook is expressed with increasing candor and technical skill in the later novels.

Microfilm $5.05; Xerox $17.00. 394 pages.

WITHIN LIMITS: THE NOVELS OF JAMES GOULD COZZENS

(L. C. Card No. Mic 58-3323)

Edward Lawrence Galligan, Ph.D.
University of Pennsylvania, 1958

Supervisor: Professor Robert E. Spiller

This is a critical analysis which attempts to find the principles that shape the novels of James Gould Cozzens. It devotes comparatively little attention to Cozzens' first three novels (Confusion, 1924, Michael Scarlett, 1925, and Cock Pit, 1928), for they are plainly apprentice pieces. It is mainly concerned with the eight novels and novelettes which Cozzens published between 1929 and 1948 (The Son of Perdition, S.S. San Pedro, The Last Adam, Castaway, Men and Brethren, Ask Me Tomorrow, The Just and the Unjust, and Guard of Honor). His twelfth novel, By Love Possessed, was not published until August, 1957, after this dissertation was largely written; it is, therefore, considered apart from the others in an essay at the end. The source material for this study consisted almost solely of the novels themselves. This is not in any part a biographical study; and very little had been written about the novels when this study was made.

Careful analysis of the novels led to this thesis: that a conviction that man is imperfect and life endlessly complex informs all aspects of Cozzens' novels. Not only the themes but also the manners and methods of his novels are governed by this two-pronged conviction and from a few other basic convictions which are closely related to it.

The dissertation contains six chapters plus the appended essay on By Love Possessed. The first chapter describes the distinctive qualities of the novels. The second deals with the ideas which are fundamental to them, the philosophical postulates and conclusions which are at the core

of Cozzens' work. Briefly stated, they are as follows: man is imperfect; man has free will; life is fundamentally complex and obscure; life is fundamentally good; a man must do the best he can with whatever talents he has; his chief but ultimately inadequate talent is reason; he needs a sustaining system of values which cannot be either simple or rigid.

The remaining four chapters are primarily concerned with showing the way these fundamental ideas shape various important aspects of the novels. Chapter three deals with the mode. The novels are realistic, though not naturalistic, and they are strongly anti-romantic. Significantly different from novels in the Dreiser, the Hemingway, and the James traditions, they are in a neo-classical, Johnsonian tradition. Chapter four analyzes the tone, finding that in both style and content the novels are permeated by wit and irony. The fifth chapter shows how the fundamental ideas determine the kinds of characters that appear in the novels and also the ways in which they are characterized. Chapter six shows how the novels demonstrate Cozzens' growing mastery of the techniques of realistic fiction; in conclusion it asserts that the novels render with skill and lucidity a complex, tenable understanding of the way life is. In the addendum, By Love Possessed is seen as containing in heightened form the qualities, techniques, and concerns characteristic of Cozzens' other novels.

Microfilm $2.60; Xerox $9.00. 198 pages.

MADAME DE STAEL AS A NOVELIST

(L. C. Card No. Mic 59-1003)

Madelyn Gutwirth, Ph.D.
Bryn Mawr College, 1958

Although much has been written about Madame de Staël as a historic figure or as a literary influence, there has been little attempt to study her works themselves. This is especially true of her two novels. The import of Delphine and Corinne, which were acclaimed in Madame de Staël's day, has been all but forgotten.

Madame de Staël's parents play a very important role in her life and in her works, for she recreates her struggles with them in her fiction. The early fiction is highly naive, but it gives us significant insight into the novels. The events of Madame de Staël's early life also penetrate her novellas and plays.

The early critical works, De la littérature and l'Essai sur les fictions, as well as the Lettres sur le caractère et les écrits de J.-J. Rousseau tell us Madame de Staël's ideas concerning fiction, poetry, and literature in general.

Delphine's characters are the most successful element of that novel, the plot its least successful element. The reason for the latter is Madame de Staël's lack of conscious artistry, her lack of plan. The important themes of Delphine are well communicated to the reader, though they are repeated too insistently. They are: the lot of the superior woman in society, and the problems of marriage and religion. The upsetting quality of the novel has to be accounted for.

Corinne grew out of Madame de Staël's trip to Italy and her feelings concerning her father's death. Along with her discovery of Italy, Corinne reveals the new significance of art to Madame de Staël. The few characters of Corinne are depicted with considerable success, on the whole, the hero less well than the heroine, who dominates the work. The lesser characters are well-drawn. Corinne's travelogue is an intrusive element to the novel proper, though Madame de Staël has tried, with some occasional success, to merge the two. The style of Corinne is faulty. The improvisations are not poetic as they really ought to be, but there are narrative and conversational passages which are written with great effectiveness.

The power of Corinne lies in the struggle of the woman of genius to keep her lover. Since he is an Englishman rooted in the conventions, the Italian Corinne basically seems odd and alien to him. The curious mood of the end of the novel is dictated by the irresolution of the author, for whom the problem she poses is insoluble.

Delphine and Corinne stand on the threshold of the nineteenth century: Delphine, in style, rather looks back; Corinne is more truly romantic, but both novels are works of rebellion against society. The impact of the heroine Corinne on the course of the nineteenth century novel has perhaps been underestimated.

Delphine and Corinne are intimately related to Madame de Staël's inner experience of the struggle of the woman of exceptional endowment to be loved and accepted, and recognized as well. But although these novels are in a sense autobiographical statements, they transcend the particularities of Madame de Staël's life. Corinne, in particular, is re-evaluated in terms of the force and effectiveness with which the problem of the superior woman is posed. Madame de Staël's Corinne can then be understood as a surprisingly powerful statement of a timeless question, and the meaning which it held for the nineteenth century reader no longer seems so remote.

Microfilm $5.60; Xerox $19.60. 437 pages.

MAX MELL, DRAMATIST

(L. C. Card No. Mic 58-3100)

Joseph Francis Hill, Jr., Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor Erich G. Budde

Despite the important role played by Max Mell in contemporary German literature, attested by his many literary honors, little is known about him in this country, mainly because no one has yet published either a biographical or critical interpretation of his work, here or in Europe. This dissertation is designed to contribute to a fuller understanding of Mell's works through an analysis and critical study of the eight dramatic works he has written to the present time. A complete bibliography of his entire literary output to date and articles, reviews, and other materials relating to him, among them several unpublished dissertations, has been included as an aid to further research.

The study first presents information relative to Mell as a person, then continues through a discussion of the tradition of the popular drama and its modern revival to a chapter-by-chapter analysis of the individual dramas, whose themes range from the classical Sieben gegen Theben

to a modernized Jeanne d'Arc. I have traced his earlier attempts in lyric and narrative prose, his sincere love of popular Austrian folk-tradition and history, his deep personal feeling of responsibility to his fellow man, his devotion to the unities, and his unshakable belief in Christian ethics. Many of the themes which we found in his prose and poetry later reappear more fully developed in his drama.

Even prior to World War I, we find evidence of growth beyond the art-for-art's-sake-stage of his work appearing in his short stories and his poetry. Mell's experience at the front during World War I, and the misery and suffering which he observed around him during the post-war period, strongly influenced his development, and during the ensuing decade, he manifests a deep feeling for struggling humanity and a responsibility to help mankind overcome its problems and apprehensions.

The popular dramatic tradition and its revival have been traced in order to show Mell's position within this literary form which because of its association with the portrayal of simple and reverend concepts was the ideal vehicle for his ideas. In his later drama, Mell has turned to distinguished literary themes, and this has made necessary a comparison of these works with parallel dramas by other outstanding authors such as Aeschylus, Sophocles, Shakespeare, Schiller, Hebbel, Anouilh, Péguy, and Shaw.

The analysis of his plays demonstrates the personal nature of the change which Mell believes must take place if mankind is to find its salvation, that is, the fact that each individual must take upon himself the responsibility for reflecting universal love to the fullest extent of which he is capable.

Throughout his dramas, Mell's characters perform in an environment carefully chosen with a view to enhancing the mood and thought of the play. Much of their effectiveness is due to the carefully worked out psychological motivation which exhausts every alternative prior to an action, yet each has a common denominator, i.e. that the development which is needed for the salvation of mankind is an inner change resulting from the interaction of one personality upon another so that it finds its place within the harmony of nature.

Microfilm $4.50; Xerox $15.20. 351 pages.

BRAND WHITLOCK: HIS LIFE AND HIS FICTION

(L. C. Card No. Mic 59-329)

Juanita Smith Kytle, Ph.D.
The University of New Mexico, 1958

It has been the purpose of this dissertation to examine the life and the fiction of Brand Whitlock. Especially sensitive to the forces of his years (1869-1934), Brand Whitlock was a natural eclectic whose interest in many facets of life and knowledge remained undiminished to the end. He lived in an age of rapid change which followed what he thought of as a golden age of American history and literature. He himself changed as rapidly as the world he lived in. He became in turn a journalist, a novelist, a lawyer, a reformer, a mayor, a diplomat, and an expatriate; and from each experience he emerged a little more bitterly disillusioned and a little more firmly nostalgic for a constantly retreating past.

However, despite the apparent changes revealed in his fiction, his letters, his journals, and in his way of living, there is a curious consistency in Brand Whitlock's life and fiction which urges that Whitlock never really changed his basic faith and character. As a boy he was homesick for a vanished Southern aristocracy which the character and the stories of his Grandfather Brand had made real to him. As a young man, he became a crusader for reform. As an older man, after the political and diplomatic experiences, he seemed to lose his faith in democracy and to believe only in the traditional, in the old, and in the artistic. The nostalgia of the boy had deepened and broadened so that the older Whitlock was homesick for all the vanished and imagined glories of a "better past." Out of a belief that things had been much better in the past, came the belief that reform could lead to a better future. Out of the disappointments which came from the failures of reform, came the cynicism which in turn became a new nostalgia.

In his fiction Brand Whitlock reflected his changing experiences and values, beginning as a political novelist (The 13th District), encouraged by William Dean Howells, moving on to novels of social protest (The Turn of the Balance), then to the more mature novel of Ohio puritanism (J. Hardin & Son), and finally to the "European" novels (Uprooted and Transplanted) in which he revealed his essential concern with the problems of the artist and his esurient appetite for the values of a vanishing European culture.

Brand Whitlock was not a great writer, but at least four of his novels, The 13th District, The Turn of the Balance, J. Hardin & Son, and Uprooted, are worthy enough to give him a secure if minor place on the roster of modern American writers who deserve to be remembered with respect. Microfilm $5.20; Xerox $18.40. 408 pages.

THE COMIC ELEMENTS IN MORETO'S COMEDIAS

(L. C. Card No. Mic 59-1355)

Anna Marie Lottmann, Ph.D.
University of Colorado, 1959

Supervisor: Assistant Professor Carlos Ortigoza

Agustín Moreto y Cabaña (1618-1669) is generally classified by the critics of Spanish literature as one of the six great dramatists of the Golden Age, with only Lope, Tirso, and Calderón superior to him. Moreto had less creative force than they, but he surpassed them in dramatic technique. In addition, he had a gaiety and a comic grace superior to that of any dramatist of the age. It is the purpose of this study to present the comic elements which appear in his works and to examine them in the light of their contribution to his merit as a writer of comedias.

The comic elements are classified as farce, parody and burlesque, caricature, sarcasm and irony, satire, wit, and humor. A study of these elements must, in large part, be concerned with the character of the gracioso, for he is the real comic personage of Moreto's theater. It is he who creates and guides the complicated intrigues of the plot and motivates the dialogue of witty repartee.

In those comedies where the main interest is in character rather than action, Moreto achieves his greatest success. He has shown himself capable of depicting a

character fault as originating within the character, so that, while caricaturing individual eccentricities, he develops them from a truly psychological basis. The farcical elements in these comedies are merely surface features with the true comedy arising from the deeper imperfections and inconsistencies within the character.

Parody was a favorite tool of the gracioso to mock and ridicule the exaggerated and affected manners of his social superiors. Within the parody, he stresses the wide divergence between the idealism expressed by the nobles and his own materialistic outlook on life. Parody, sarcasm, irony, and satire form the basis of the moral aspect of Moreto's comedies. Through these elements he protests against the injustices of society and the weaknesses of human nature. Yet they do not overwhelm the gaiety of mood of Moreto's work. The cleverness of wit displayed in the form of puns, word play, riddles and figures of speech keeps the dialogue alive and moving at a quick pace. Moreto gives it a spontaneity and sense of playfulness that has the tone of shrewd popular intelligence rather than scintillating eloquence, but it is seldom coarse or crude.

In Moreto's works a gentle, kindly humor usually forms the setting against which are displayed the brilliant scenes of wit and parody, the uproarious scenes of farce, the sharp scenes of satire and irony. This background is interwoven with the observations of the servants as they view life around them. They see nature and character as it is, the true relations of one person to another and the peculiarities of each. It is this keen awareness of character and its accurate portrayal within a framework of comic action and dialogue which has imbued Moreto's comedias with a universal appeal.

Microfilm $3.30; Xerox $11.20. 255 pages.

CARLOS REYLES AND HIS SOCIAL CONSCIOUSNESS OF THE URUGUAYAN SCENE

(L. C. Card No. Mic 59-1018)

Vincenza Ann Mattiace, Ph.D.
New York University, 1958

Chairman: Professor Emil Lengyel

The problem in this dissertation was to make an inquiry into the life and writings of Carlos Reyles, the Uruguayan social critic and philosopher. The purpose was to show that he possessed to a marked degree the characteristic of social consciousness, for in his writings and activities he stressed the social conditions of his country, pointing out the weaknesses of the antiquated social institutions and customs.

At the beginning of his career, he stated as his credo, truthfully and fearlessly to portray the social conditions as he found them. He lived up to this credo. In all his writings but two, "El Capricho de Goya" and El Embrujo de Sevilla, his theme was Uruguay, the evils prevailing in the country, and the remedies he proposed.

Since none of Reyles' works studied had been translated into English, the writer read them in the original Spanish. She had to do likewise with the writings of his contemporaries for their pronouncements on the Uruguayan situation and for their criticism of Reyles' comments on that situation. That procedure yielded a first-hand account of Reyles' analysis of Uruguayan social affairs and the extent to which the Uruguayan writers referred to acquiesced in his strictures.

Generally speaking, except for minor observations, the latter echoed Reyles' opinions. One important exception was provided by the Uruguayan philosopher, Rodo, who believed the lethargy of the Uruguayan people could be overcome by imbuing them with ideals and teaching them aestheticism. Reyles, on the other hand, advocated the cult of work, vital energy, "egoism," and wealth.

In his writings, Reyles concentrated on the following: rural Uruguay, its political conditions, the status of women, university education, and lethargy, the Uruguayan national characteristic.

Reyles described the deplorable conditions prevailing in rural Uruguay and the gradual disappearance of the old-type estanciero and gaucho under the impact of the introduction of scientific methods of livestock-breeding. He stressed the necessity of improving the livestock industry which he considered essential for the welfare of Uruguay. He criticized the unsettled political conditions which caused recurring revolutions and the evils of the caudillo system of political control.

The status of women in Uruguay seemed deplorable to him. Of the women of the middle class, he had little to say. But, he condemned severely the women of the upper social class for their fruitless, glittering lives and for their succumbing to the marriage mores of the country. Also, he indicted the women of the lower classes for the looseness of their morals and resulting degradation. However, he professed to an understanding of their position as a result of conditions beyond their control.

Reyles said little regarding elementary and secondary education. But, he condemned utterly the prevailing higher education in Uruguay, for its failure to prepare students for coping with life.

The inquiry showed that Reyles was a social critic and philosopher of the highest order. By virtue of his writings and deeds, he exerted a most beneficial influence on Uruguay which, during his lifetime, became a "social laboratory." As a result, he attained a place among the foremost Latin-American writers.

The inquiry suggests that the writings of Reyles be translated into English, first for the general reader and, secondly, for the college student, as a source of information regarding what can be done to help an under-developed people improve their social, economic, and political lives. Furthermore, it would be profitable to make a belles lettres study of Reyles, the literary writer, the acknowledged master of the novel, the short story, and the philosophical essay. Microfilm $4.80; Xerox $16.00. 374 pages.

ANNE BRONTË: NOVELIST OF REFORM

(L. C. Card No. Mic 58-5162)

Lewis Marvin McKneely, Ph.D.
Emory University, 1956

Anne Brontë (1820-1849), the author of Agnes Grey and The Tenant of Wildfell Hall, is comparatively unknown today except to the specialist in Victorian fiction. The

place generally accorded her in literary history is relatively unimportant and is dependent largely upon the association of her name with those of her more famous sisters.

Several previous biographers and critics of Anne Brontë have noted her opposition to women's position in Victorian society, her protests against certain tenets of Calvinism and Evangelism, and her sympathies toward the temperance movement. But none of these writers amplified or clarified their statements. The purpose of this study, therefore, is to analyze the areas mentioned in their comments to determine whether Anne's suggestions for reform were innovations or whether they were reflections of the general humanitarian tendencies of the age. Such a study is necessary before critics can reasonably estimate what her proper literary status should be. No attempt has been made to judge the artistic qualities of her novels, and any evaluation of her technique included is contributory to an analysis of her social criticism.

The social criticism embodied in her novels is divided into four areas: the evils inherent in the inequality of the sexes; the state of Victorian education; the problem of intemperance; and Victorian religious creeds. The historical background of each of these areas indicates Anne's indebtedness and her innovations.

The life of the Brontë girls reveals considerable that motivated Anne's desire for reform. Much of her criticism of the inequality of the sexes was personal, for instance, as in the relative position of the men and women in her own home she found ample evidence of this inequality. And the unhappiness caused by her brother's drunkenness provided material for her comments on drinking. Her experience as a governess made her aware of the humiliations involved in private teaching. A possible source of her concern with the double standard and the marriage of convenience was the common pool of the Brontës' experience made up of personal associations, actual happenings, Yorkshire folklore, and Methodist history.

After presenting the misery brought about by the inequality of the sexes, Anne suggested her reforms. She rejected the Victorian idea of the inferiority of women and believed that they should be treated more nearly as equals. She asked a measure of literary freedom and the right of women to earn their livelihood in a dignified and respected manner. She believed that both men and women should observe the same moral standard. She also suggested that women had the right to control their own money and children and to terminate unduly oppressive marriages.

Anne's analysis of Victorian educational system was the second phase of her social criticism. Since she was unfamiliar with universities and schools for boys, her evaluation was confined to the tutorial system which she knew. Although she might have drawn from her own experience, she also excluded schools for girls. The nature of her criticism was a somewhat harsh censure of the lack of thoroughness involved in giving basic training to boys and girls and to the superficial training accorded young women. She agreed with contemporary opinion that genteel accomplishments were worthwhile, but she felt that they should be the polish added to a thorough training in morals and the rudiments of learning.

The severest criticism that Anne meted out was reserved for the contemporary attitude toward alcohol. Having witnessed the degradation and humiliation caused by heavy drinking, Anne advocated abstinence, making clear the part that alcoholic beverages played in each level of middle-class society. After recapitulating the contemporary arguments in favor of social drinking, she refuted them. She rejected the idea that a young boy should be encouraged to face temptation in order to acquire strength necessary to overcome it. That social drinking was using the "gifts of Providence" she refuted by noting the increasing dependence upon alcohol in weaker individuals. She completely disagreed with the Victorian ideal of the "hard-drinking man" who "could hold his liquor." Her suggestions for reform included abstinence and the education of young people to the dangers inherent in social drinking.

Anne's concern with religion was equally as personal as her concern with temperance. Her early religious training, both Anglican and Evangelical, left a deep conviction of her own sinful nature, a conviction which was reflected in her novels as an inability to believe in her right to happiness. The primary cause of her modification of the Evangelical creed, however, was a search for assurance of salvation for her brother's soul. Her religious views were not necessarily new, but they were at variance with Evangelicalism and Anglicanism because of elements added from other sources. Although she rejected the evangelical beliefs in total depravity and eternal damnation for unrepentant sinners, she concurred with Evangelicalism in denying predestination and election--for these she substituted a concept of free will similar to that of Wesleyan Methodism. And she further added a purgatorial period, like that of the Catholic Church, plus a belief in the eventual salvation of the soul--her own idea.

Another aspect of Anne's social consciousness was her attitude toward the religious controversy raging during the 1840's, as seen in her satire of some members of the High Anglican clergy. Her concern was not so much with the theological aspect of the controversy as it was with the humanitarian side. Her comments on the theology and behavior of the High Church clergy indicated her rejection of "Authoritarianism" and the "Tory economic ethics" as solutions to the social problems of the day.

Anne's significance in literary history doubtless rests in good part on her accomplishment as a novelist of reform. In no sense an innovator or active reformer, she wrote two novels that are excellent reflections of the Victorian reform tendencies. Her plea for the emancipation of women was fervent, and the range of rights she sought for them anticipates the social, economic, and legal freedoms they enjoy in the twentieth century. Her plea for temperance was a manifestation of the Victorian concern with inebriation. And her view of the low state of education was indicative of agitation that brought about the Education Act of 1870. Although her novels are seldom mentioned in connection with the religious controversy of the period, they contain an excellent comparison of the clergy and theology of the High Church with that of the Evangelicals. She is important as a novelist of reform, therefore, because of the composite picture of the many current reform elements presented in her novels.

Anne is also significant as a social historian, as seen in her depiction of Yorkshire society. Though her novels reflect little contemporary social and economic upheaval, they do provide a study of the levels of society affected. Clearly and vividly she presented the social and domestic nature of the three levels of middle-class society about which she wrote. Her regional study of Yorkshire, which noted both national characteristics and regional differences, thus helps us to understand English society as a

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

whole. And her comments on the prevailing standard of morals, taken together, form a code at variance with that of her age.

Anne Brontë, therefore, deserves a higher place in literary history than she is usually accorded: primarily as a novelist of reform, but also as a historian of the contemporary social scene. A complete estimate of her literary status must await further study of the artistic qualities of her novels. In any event, however, her ultimate status should depend on her actual worth as a novelist and not merely on her relationship to her more famous sisters.

Microfilm $2.00; Xerox $7.00. 146 pages.

JOHN BUNYAN'S USE OF SYMBOLS IN THE PILGRIM'S PROGRESS

(L. C. Card No. Mic 58-5163)

Walter Edward McNair, Ph.D.
Emory University, 1956

The Pilgrim's Progress is an allegory whose primary purpose is to direct the reader towards heaven. At the same time, it is a literary work of recognized greatness. It, therefore, assumes a sufficiently important position to justify a variety of efforts and approaches which may suggest new ways of explaining its artistic eminence and provide new avenues for further appreciation of its allegorical meaning.

As an allegory, The Pilgrim's Progress is an extended metaphor of the life of a Christian in his struggles to reach the City of God. Just as the whole work is one gigantic symbol, so its constituent parts are made up of many and varied smaller symbols which contribute cumulatively to its total effect. Rosemary Freeman in her volume English Emblem Books has said that Bunyan seldom "adds a detail" which does not have allegorical significance, and he himself has enjoined his reader to give attention to his metaphors. These symbolic details, however, do more than give meaning to spiritual truth; they also add immeasurably to the aesthetic and literary value of the tinker's masterpiece.

Aside from any element of moral edification, The Pilgrim's Progress tells an absorbing and fascinating story; it also has definite form and structure, and its characters live with vitality and reality. It, moreover, presents a superb argument for Bunyan's conception of the Christian life and at the same time has the necessary variety to avoid the pitfalls of monotony. Now, in each of these areas Bunyan utilizes symbols -- both large symbols and small ones -- to give added power and scope to his work. They enhance the romantic effect of the story; they provide unity and coherence for the structure, and they contribute dimension and cogency to the characters. They also add such point to Bunyan's argument that it becomes evident that The Pilgrim's Progress is freighted with allegorical values beyond what may at once be obvious. It is relevant and valuable, therefore, to study how Bunyan used specific terms which are representative of a variety of ideas and of how he so related them to life that they successfully convey his meaning to his reader and at the same time add to the artistic merit of his masterpiece.

Of the larger symbols in The Pilgrim's Progress, much has been observed, and their meaning is not difficult to understand. Devices such as the City of Destruction, the Slough of Despond, the House Beautiful, the twin valleys of humiliation and death, Vanity Fair, Hill Lucre, Doubting Castle, the Delectable Mountains, the Enchanted Ground, the Land of Beulah, and finally the River of Death and the Celestial City -- all of these have meanings not elusive of approach. Likewise, the numerous characters, either by their names or by some betraying mannerism or method of speech, lend themselves to easy interpretation; the same is true of the fiends and giants and monsters met in the course of the journey. But, as has been said, Bunyan seldom "adds a detail" which does not have allegorical significance. What of these details and their symbolic importance? Strangely enough, little attention has been given to this whole area of significance in The Pilgrim's Progress, an area the investigation of which gives new depth and perspective to the genius of John Bunyan and added distinction to his masterpiece. Herein lies the real purpose of this entire study in which more than two hundred of these "details" of symbolic importance are singled out for explication, dictionary-wise.

In this project, an effort has been made to trace a symbol through both parts of The Pilgrim's Progress, with care being taken to give adequately the context in which each use of the symbol occurs. This setting forth of how and where Bunyan uses a symbol is followed immediately by an explanation of the meaning of the symbolism in terms which fit the context of the allegory. In many instances a symbol may have more than one meaning, but if some interpretation does not throw light on Bunyan's use, its meaning has been passed over and attention concentrated on those relevant to Bunyan's text. In searching out these interpretations, a number of sources have been used, and recent scholarly commentaries on symbolic meanings have been heavily relied upon. First interest, however, has naturally centered on seventeenth-century symbolic commentaries. It should also be emphasized that this study is concerned with the meanings and interpretations of the symbolic details of The Pilgrim's Progress and not with the sources of the symbols. Emphasis has been placed on the "what" and not on the "where."

It should be further observed that the conclusions which are advanced in this treatment are meant to be merely suggestive of the possibilities of a fuller application of the symbolic meanings which have been developed and catalogued for convenient reference in the major part of this study. However, it has become increasingly evident that for illuminating Bunyan's allegorical purposes, for illustrating his literary technique, and for affording a clearer insight into the general spirit and outlook of seventeenth-century Puritanism, a continuing study of the symbols in The Pilgrim's Progress offers the possibility of a consistently enlarging area of investigation and analysis.

As a result of this study, Bunyan emerges with added stature as a stylist and craftsman of extraordinary ability. He so excelled in the naturalness of his writing that subsequent generations have been prone to discount his toil and to emphasize unduly his native genius. That he had native genius is an irrefutable fact; that his genius was not formally trained is another recognized fact; that his primary purpose in writing was to teach is again subject to no debate. But to imply that Bunyan took no conscious care of the literary merits of his masterpiece is to go afield. In story, in structure, and in characters The

Pilgrim's Progress shows the hand of a craftsman who knew what he was doing and how to go about doing it. But Bunyan reveals his art supremely in his use of symbols. The detailed knowledge which he demonstrates and the sure touch which he shows in his choice of the precise device to illuminate his meaning and accomplish his purpose could not have come by mere chance. The weight of too much evidence testifies otherwise. Rather, it seems reasonable to assert that Bunyan was a conscious literary artist who with consummate skill used his art to create a masterpiece which in the light of this circumstance takes on new meaning, new splendor, new wonder.

Microfilm $3.70; Xerox $12.40. 284 pages.

THE PLACE OF THE UNVANQUISHED IN WILLIAM FAULKNER'S YOKNAPATAWPHA SERIES

(L. C. Card No. Mic 58-7868)

James B. Meriwether, Ph.D.
Princeton University, 1958

William Faulkner's The Unvanquished is in many ways the most neglected of those of his works which deal with the imaginary Mississippi county of Yoknapatawpha. Published in a small edition in 1938 and long out of print, save in paperback, it has received very little critical or scholarly notice. No extended study of the work has previously appeared, though the need for such a study is reflected in present critical disagreement concerning both the merit of the book and its form.

In this dissertation I have attempted both to fill the need for an extended investigation of The Unvanquished and to make use of several new approaches, in that investigation, to some general problems of Faulkner scholarship. The center of the dissertation is the three chapters devoted to The Unvanquished. In the first of these is reviewed the history of the publication of the book, six of whose seven chapters had appeared first in short story versions. Also discussed in this chapter are bibliographic details of the publication of the book, foreign translations, and its initial critical reception, which was on the whole unfavorable. In the following two chapters, the "themes" of the book are discussed in detail. The emphasis here is upon the characters, particularly the members of the Sartoris family who are the principal characters of the book, and their qualities and their meaning. By showing how Faulkner revised the first six chapters from their short story versions, and by showing how the themes of the work are carefully developed and related to each other from chapter to chapter, I have tried to show that the unity of The Unvanquished requires its designation as a novel, and that most of the meaning is lost when its unity is overlooked.

The first and the last chapters of the dissertation are concerned with one particular, and basic, approach to the question of the relationship of The Unvanquished to the other works of the Yoknapatawpha series. In the first chapter the members of the Sartoris family are discussed in the works which were published before The Unvanquished; in the last, these characters are discussed as they appear in the works which were published after 1938. Together, these two chapters attempt to relate The Unvanquished to the rest of Faulkner's works rather than to illuminate its meaning by discussing related works. The results of this approach, so carried out, show clearly that it is for several reasons highly dangerous to assume too great a unity in the Yoknapatawpha series, and the misreading of the individual work generally follows any attempt on the part of the critic to subordinate the unity of one work to the unity of the series as a whole.

The Appendices represent a further attempt to study The Unvanquished both in itself and in relation to the other works of the Yoknapatawpha series. Just what that series comprises is the subject of "Faulkner's Fiction: An Annotated Check List," which represents the first attempt in more than twenty years to distinguish between Faulkner's Yoknapatawpha and non-Yoknapatawpha works. The locale of The Unvanquished is discussed in "The Region," which also supplies several maps and photographs. A complete list of the characters in The Unvanquished is given in a third Appendix, with brief discussions of family relationships. The difficult question of the contradictory chronology of the book is discussed in the fourth Appendix, which offers a number of suggestions concerning possible revisions of the text which might, in a future edition of The Unvanquished, clear up many of the inconsistencies which exist in the present form of the work.

Microfilm $2.80; Xerox $9.80. 216 pages.

THE IDEA OF NOTHINGNESS IN THE POETRY OF PEDRO SALINAS

(L. C. Card No. Mic 59-330)

Julian Irving Palley, Ph.D.
The University of New Mexico, 1958

This essay is an attempt to prove that a conflict or dialectic between Being and Non-Being, between love and nothingness, can be traced throughout the poetry of Pedro Salinas. The Introduction is concerned with a general definition of poetry. The first chapter is a brief history of the idea of nothingness in philosophy, mysticism and poetry. The idea of nothingness appeared in the pre-Socratic Greek philosophers, who were concerned with its ontological implications. It occurs in the writings of Saint Augustine and Aquinas. It is significant in mysticism, particularly in the works of San Juan de la Cruz and Miguel de Molinos. In modern times the movement generally known as Existentialism, in which nothingness plays a pivotal role, started with Hegel and Kierkegaard, and culminated in Sartre and his contemporaries. The idea of le néant was also present in work of many great poets, particularly the Golden Age poets of Spain and the symbolists in France.

A careful examination of the poetry of Salinas, from his earliest book, Presagios, in which the struggle is suggested, to Todo más claro, in which it is carried to its conclusion, reveals a continual and increasing preoccupation with this theme. There is, for example, the reduction to Non-Being of Miguel de Molinos, and the dark night of San Juan. There is Baudelaire's gouffre and Sartre's néant. Salinas, poet of love, deserves also the title of mystic.

Salinas is one of the great love poets of the Spanish

language. But whereas human love occupies but one phase -- perhaps the finest -- of his poetic development, the struggle here outlined, between love and le néant, is present, in various forms, throughout the trajectory of his work, gaining in relief and intensity until the final poems which are documents of an almost unbearable inner struggle. It may therefore be said that this dialectic is central to his poetry, and vital to the unfolding of the great clarity of his work. Microfilm $2.40; Xerox $8.40. 181 pages.

RENAISANCE AND BAROQUE: MULTIPLE UNITY AND UNIFIED UNITY IN THE TREATMENT OF VERSE, ORNAMENT, AND STRUCTURE

(L. C. Card No. Mic 59-1176)

Roger Loren Parsons, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Merritt Y. Hughes

This study hypothesizes that seventeenth-century poetry can be distinguished from sixteenth-century poetry in terms of Heinrich Wölfflin's fourth category of distinction between renaissance and baroque art, the "multiplicity-unity" category. Seventeenth-century poetry may be called baroque because in contrast to the multiple unity of sixteenth-century poetry it has unified unity.

The study involves important methodological assumptions. First, it is crucial to discriminate between the intention to use baroque as a period concept, to denominate that which seventeenth-century poetry at large shares in common, and the intention to use baroque as a stylistic concept, to distinguish one style of seventeenty-century poetry from others. Second, it is important to recognize the limitation of the intention: that the characteristic by virtue of which a work is said to be baroque may not be of first critical importance for its understanding and will certainly not constitute an exhaustive description of it. Third, it is necessary to see that questions concerning periodicity and the similarity between renaissance and baroque need not be considered in the attempt to distinguish between renaissance and baroque and have no bearing on the validity of any conclusions reached.

There is strong a priori support for the present hypothesis. While the change from multiple to unified unity occurred in art, developments in art theory tended to emphasize the two elements which Wölfflin believes interact to produce unified unity: the development of a dominating total motive and the cessation of the independent functioning to individual forms. The same two elements were also emphasized by certain developments in the literary criticism of the late sixteenth and of the seventeenth centuries. One is the growing classicism with its emphasis on a strict unity; a second is the growing tendency to emphasize an an important function of stylistic features their ability to express thought; a third is the increasing technical skill which made possible a less obtrusive use of stylistic devices.

This study demonstrates that seventeenth-century poetry reveals unified unity in its treatment of verse, ornament, and structure. Whereas in sixteenth-century poetry syntactical divisions tend to reinforce the divisions defined by the line and by rime, in seventeenth-century poetry the syntactical divisions often work against them, thus destroying their near-independent status. For example, on this basis we contrast Surrey's and Gascoigne's blank verse with Milton's, Spenser's sonnet verse with Donne's and Milton's, and the stanzaic and couplet verse of Spenser, Wyatt, Daniel, Marlowe, and others, with that of Milton, Donne, Jonson, Crashaw, Marvell, and others. Whereas in sixteenth-century poetry the image tends to be developed as an object which though relevant to the whole is in addition of interest in itself, in seventeenth-century poetry the image tends to be subordinated to its relevance. For example, on this basis we contrast Spenser's and Sidney's images with Donne's, Spenser's epic similes with Milton's, and Surrey's analogies with Dryden's. Finally, whereas in sixteenth-century poetry wholes tend to be built up out of co-ordinate episodes and parts, each retaining a certain independence of status, in seventeenth-century poetry wholes are built up out of parts which are clearly ranked as dominant and subordinate, and whose independence of status tends to be destroyed. For example, on this basis we contrast the lament for Dido in "November," Shepheardes Calender, with Lycidas, and the Faerie Queene with Paradise Lost.

Naturally the poetry of the century is not perfectly homogeneous in this respect. Indeed some poems do not reveal unified unity at all. But in general works which otherwise are very unlike will, when contrasted to proper sixteenth-century works, reveal unified unity.

Microfilm $6.55; Xerox $22.80. 516 pages.

IMAGE AND THEME IN THE TETRALOGY OF THOMAS WOLFE

(L. C. Card No. Mic 58-5179)

Larry Jerome Rubin, Ph.D.
Emory University, 1956

The present study represents an attempt to analyze the four major novels of Thomas Wolfe in terms of their recurrent themes and images and to determine the type of organization such recurrence imposes upon the tetralogy. The history of Wolfean criticism indicated the need for a closer look at these matters than has hitherto been presented, for since 1929, when Wolfe's first novel appeared, adverse criticism of his works has tended to center on an unqualified condemnation of their lack of a clear-cut, unified structure. The author, indeed, has been constantly berated for his "appalling indiscipline" and for his "diffuseness."

There are several critics, however, who, while admitting the lack of conventional plot structure in these books, yet insist that there is a certain kind of design in the way the novels are put together. As the basis of this design, they find, not the usual minor and major crises, climax, and denouement, but a polyphonic development of themes that recur throughout the work. The analogy, of course, is to musical form. Readers of Aldous Huxley's Point Counter Point will recognize the significance of these references to contrapuntal design, since that novel is probably the outstanding example of the type. Basically, the principle is fairly uncomplicated: a group of themes is stated at the beginning of a novel, and these themes are then developed or restated with variations at different places throughout the work. They are, that is to say, recurrent themes. Since they move along in more or less parallel

fashion, they may also be viewed as concurrent themes. By means of this recurrence, the many episodes and events which Wolfe has narrated are provided with unifying threads. Apparently unrelated parts of the novels have thus been shown to be connected by means of the recurrent themes which these particular parts express. Indeed, the main thing the present study has shown is that the unity in diversity which many aestheticians recognize as the sine qua non of any artistic work is, in a large measure, supplied in these novels by this thematic design. In this pattern each strand of meaning (that is, each recurrent or repeated theme) illuminates or ties together a number of narrative episodes and lyrical passages which appear at more or less widely scattered points in the tetralogy.

In analyzing this problem, we find that Wolfe's images play a vital role in the working out of the thematic pattern; for he uses recurrent images to convey his recurrent themes. As this dissertation shows, the pattern implied by the use of such imagery has a great bearing upon the problem of Wolfe's "formlessness."

The present study, then, constitutes an analysis of the significant imagery in the four major novels of Thomas Wolfe in terms of theme and structure. Both terms of the expression "significant imagery" will bear definition. By "imagery" I mean not merely mataphors and similes, but all those devices of symbolism and myth by means of which the author attempts to render his underlying meanings--to convey the abstract by means of the concrete. For example, certain characters in the novels have been shown by critics to possess symbolic value; such characters may be said to partake of the quality of images in the sense that they "figure forth" in tangible form the thoughts and emotions of the writer. Also, certain feelings and ideas are tangibly represented by scenes which draw upon the sensory data provided by the world of nature: the rural landscape of Virginia, for instance, as seen "dreaming in the moonlight" from the windows of a speeding train becomes an image of the permanence of the earth contrasted to the ephemeral, fleeting nature of man's life. Another type of image is purely "imaginary" in the literal sense, existing only in the mind of a character, but acquiring image-value by virtue of its power to project that character's fancy into the realm of the physically conceivable. A boy's mental vision of "the shining city," for example, becomes, in these terms, a legitimate image of the fame and glory youth longs for--an image representing a kind of wish-fulfillment on the level of romantic fantasy. Whatever form the image takes, then, it is characteristically distinguished by this capacity to inform the abstract concept with a sensuously apprehensible substance--or, in Biblical terms, to clothe the spirit with flesh. The use of images is, in short, the method of the poet.

The qualification expressed by the term "significant" is intended to be severely restrictive. By "significant imagery" I mean those images and groups of images which have meaningful relation to Wolfe's basic themes--ideas which permeate or dominate the entire tetralogy, or which are important in some phase of the hero's development. This restriction eliminates from consideration images used simply to make a passing thought or feeling more vivid and those employed purely as poetic ornaments. "significant imagery," then, is to be understood as imagery having thematic relevance within the context of Wolfe's writing.

The present study indicates that although some of Wolfe's imagery is occasional in purpose, undeveloped in form, and diffuse and inconsistent in meaning, there yet exists a hard inner core of vital recurrent imagery which not only imparts a poetic quality to the individual passages, but gives a kind of pattern to the whole--a pattern of the contrapuntal type discussed above. As for the precise nature of Wolfe's significant images, they are much too numerous to be listed here; but they tend to fall into groups or clusters which move through the books with the major recurrent themes, especially those of the lost paradise, alienation, the quest for love and fame, the growth of the hero's sense of social consciousness, and his wish to halt the flow of time. Aside from the image of the "shining city" and the symbolic refrain, "you can't go home again," which are discussed elsewhere in this Abstract, of particular significance are the "stone-leaf-door" symbols as images of the Wordsworthian lost paradise of pre-existence, the web as an image of the pattern of the hero's memory, the river as an image of time's endless flow, the unopened door as an image of the hero's sense of alienation, and the train as an image of the escape which must prelude his quest.

It is important to note that although these themes and their associated images are characteristically recurrent, there is a tendency for certain themes to dominate certain sections. For example, the theme of the lost paradise is apparent chiefly in Look Homeward, Angel, the main book about the hero's childhood. The quest motif is paramount in Of Time and the River and The Web and the Rock, and the hero's sense of social consciousness is not fully developed until the later part of You Can't Go Home Again. Moreover, the central theme of the lost paradise may be called the "generative" theme, since it gives rise to most of the others. Again, many of the themes are stated or strongly foreshadowed at the beginning in the prose poem which prefaces Look Homeward, Angel; and they are all brought together and resolved at the end in the symbolic refrain, "you can't go home again." Finally, a given image oftentimes conveys more than one theme; when this occurs, a relationship between the themes involved is being, not simply indicated, but artistically rendered. Thus, music is not only a reminder of the lost paradise of pre-existence, but also an image of the hero's joy in life--a joy associated with his quest for love and fame. The relationship between the themes, rendered by the dual function of the image, is clear: the happiness of the prenatal soul, lost at birth, may be regained to some extent on an earthly level by the fulfillment of this quest. These various relationships among the motifs keep them from being absolutely parallel in an isolated, independent sense; and it is this fact which makes the analogy of contrapuntal music, with its connotation of harmony among related themes, even more appropriate than the more obvious figure of parallel strands in a loom.

Although it lacks a tightly organized plot structure of the conventional "craftsmanlike" type, then, the tetralogy does contain a coherent thematic pattern whith serves to unify the otherwise diffuse conglomeration of the author's material. Those readers who will agree that "form" need not depend upon plot alone will find that Wolfe's pattern of themes and images provides that aesthetic "unity in diversity"--that organic wholeness--which since the time of Aristotle has been the chief distinguishing feature of the work of art. Consequently, whatever other flaws the critics find in the tetralogy, their unqualified charges of formlessness are, in the final analysis, aesthetically untenable.

Microfilm $2.55; Xerox $8.80. 195 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A STUDY OF SOME SEMIGROUPS OF MOEBIUS TRANSFORMATIONS

(L. C. Card No. Mic 59-1432)

Charles Ballantine, Ph.D.
Stanford University, 1959

This paper is concerned with the action of the Moebius group on the N-dimensional Moebius space and in particular on a spherical domain D in that space. It generalizes certain results obtained by Loewner ["On some transformation semigroups," J. Rat. Mech. Anal., Vol. 5 (1956), pp. 791-804] and contains other related results.

Let $\mathcal{M}^*$ be the semigroup of proper Moebius maps taking D into a subset of D, let $\mathcal{H}$ be the group of all (Moebius) maps taking D onto D, and let $\mathcal{H}_0 = \mathcal{H} \cap \mathcal{M}^*$. A map which is Moebius-similar to an ordinary translation is called a Moebius translation. A Moebius translation in $\mathcal{M}^*$ which keeps fixed all circles through a vector at a boundary point of D making a nonobtuse angle ω with the inner normal is called an ω-translation (of D). Then $\mathcal{M}$ (called $\mathcal{M}_D$ by Loewner) denotes the smallest closed semigroup which contains the 0-translations of D. $\mathcal{M}'$ (called $\mathcal{M}'_D$ by Loewner) denotes the semigroup of maps in $\mathcal{M}^*$ which do not increase the volume of any part of D relative to any point outside of D (this volume concept is defined in the abovementioned paper).

At first only N = 2 is considered. The maps of $\mathcal{M}^*$ are characterized by inequalities, and canonical forms for $\mathcal{M}^*$ under $\mathcal{H}_0$-similarity are derived. $\mathcal{M}'$ is interpreted in terms of the hyperbolic geometry in D (Poincare model): A map in $\mathcal{M}^*$ is in $\mathcal{M}'$ if and only if, at each point D, it decreases the hyperbolic line element at least as much as does the 0-translation taking this point into the same image point. Various other conditions on $\mathcal{M}'$ are derived. A one-parameter family of closed $\mathcal{H}$-invariant semigroups $\mathcal{M}'(\omega)$, $0 \le \omega \le \frac{\pi}{2}$, is constructed, with the properties that $\mathcal{M}'(\omega)$ contains no nontrivial ω_1-translations if $|\omega_1| > \omega$ and $\mathcal{M}'(\omega)$ contains all ω_1-translations if $|\omega_1| \le \omega$, and that $\mathcal{M}'(0) = \mathcal{M}'$ and $\mathcal{M}'(\frac{\pi}{2}) = \mathcal{M}^*$. A closed $\mathcal{H}$-invariant semigroup including $\mathcal{M}$ and strictly included in $\mathcal{M}'$ is derived, together with its extremal maps (which are maps of $\mathcal{M}$). Then it is shown that the only $\mathcal{H}$-invariant subsemigroups of $\mathcal{M}^*$ which are not included in $\mathcal{H}$ and which are generated by their infinitesimal transformations are the semigroups $\mathcal{M}(\omega)$, $0 \le \omega \le \frac{\pi}{2}$, where $\mathcal{M}(\omega)$ is defined as the smallest closed $\mathcal{H}$-invariant semigroup containing the ω-translations of D.

Then the case of general $N \ge 2$ is considered. The infinitesimal maps of $\mathcal{M}^*$ and $\mathcal{M}$ are characterized, and it is shown that the latter satisfy a system of first order linear homogeneous partial differential equations, which have an interpretation in general Riemannian geometry. This system is completely integrable in a C^4 Riemannian N-manifold if and only if the manifold has constant curvature. Microfilm $2.00; Xerox $5.60. 111 pages.

SOME SEQUENTIAL PROCEDURES FOR ORDERING POPULATIONS ACCORDING TO MEANS, VARIANCES AND REGRESSION COEFFICIENTS

(L. C. Card No. Mic 59-340)

Ishverlal Surchand Bangdiwala, Ph.D.
North Carolina State College, 1958

Supervisor: Robert James Monroe

Sequential procedures are derived and outlined, step by step, for ordering normally distributed populations according to three characteristics, namely:

(i) Means
(ii) Variances
and (iii) Regression coefficients.

In each of these three cases, four different kinds of ordering decisions are treated and for each of these a sequential procedure is proposed. These four decisions are:

(1) To determine the t "best" (unordered) populations out of k populations
(2) To determine the best of k populations
(3) To determine the t "best" (ordered) populations
(4) To determine complete ranking of k populations.

The "bestness" of the population is defined in the three cases as follows:

(1) For means, the best population is the one having the largest mean,
(2) For variances, the one having the smallest variance, and
(3) For regression coefficients, the one having the largest positive coefficient of regression.

For each of the above 12 cases (Goals), the probability distribution function is derived and a sequential procedure is proposed which gives a stop rule guaranteeing the minimum probability P^* (predetermined) of achieving the correct goal when the specified condition or conditions are met about the minimum (predetermined) difference (δ^*) desired to be detected between the two true means, or between the two true regression coefficients, or about the minimum ratio (θ^*) of the two true variances.

Illustrations are given for the computational procedures of computing the decision probabilities in the goals considered. The process of taking more observations stops as soon as the desired level of probability is reached. Microfilm $2.00; Xerox $4.20. 80 pages.

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ON PARTITIONS INTO UNIT AND PRIME SUMMANDS

(L. C. Card No. Mic 59-889)

Eugene Whitely Bold, Ph.D.
St. Louis University, 1958

We denote by $P_k(n)$ the number of partitions of n into $1,p_1,p_2,\ldots,p_k$, where $p_1,p_2,\ldots,p_k$ are distinct primes. Using the generating function concept, $P_k(n)$ is represented as the sum of two functions, $R_k(n) + Q_k(n)$, where $R_k(n)$ is a polynomial in n of degree k and $Q_k(n)$ is a bounded function of n for a fixed k.

Specifically,

$$R_k(n) = \sum_{s=0}^{k} A_{k,k-s} \binom{n+s}{n},$$

where the $A_{k,k-s}$ for $s = 0,1,\ldots,k$ are functions of $p_1,p_2,\ldots,p_k$. Two methods for determining the $A_{k,k-s}$ for $s = 0,1,\ldots,k$ are given. The first method obtains the coefficient recursively, while the second method expresses each coefficient as a determinant.

Also

$$Q_k(n) = \sum_{r=1}^{k} \sum_{t=1}^{p_r-1} [p_r\, w_r^{nt} (1-w_r^t) \prod_{s=1}^{k*r} (1-w_r^{tp_s})]^{-1},$$

where w_r for $r = 1,2,\ldots,k$ is the primitive p_r^{th} root of unity $\exp(2\pi i/p_r)$. Bounds for $Q_k(n)$ are established and discussed.

Special cases where $P_k(n)$ can be expressed as the nearest integer to $R_k(n)$ are given.

The case for $k = 5$ is treated in detail and some illustrative material is included.

Microfilm $2.00; Xerox $3.60. 63 pages.

AN INTRODUCTORY ANALYSIS OF COMPLEX FUNCTIONS BY THEIR FOUR-DIMENSIONAL REPRESENTATION

(L. C. Card No. Mic 59-893)

Rev. Theodosius Laszlo Demen, S.O. Cist., Ph.D.
St. Louis University, 1958

It is possible to establish a one-to-one correspondence between complex functions $w = u + iv = f(z) = f(x^1 + ix^2)$ of a complex variable and the pointset S of a four-dimensional Euclidean space. By this correspondence every complex function can be thought as being "represented" by a pointset S of E_4.

This dissertation attempts to give an introductory analysis of complex functions, based upon the geometrical investigation of their representation.

The method followed is this: instead of the customary analytic treatment of the function $w = f(z)$, the corresponding pointset S of E_4 is studied by means of analytic and differential geometry. Geometrical properties of S are described and identified, whenever possible, with those properties of the corresponding functions that are obtained by the customary analysis.

By this method, all elementary definitions and theorems as single or multiple-valuedness, limits, continuity, have a corresponding equivalent in the language of geometry.

Considering the case where S forms a manifold S_2 representable by the following set of parametric equations:

$$\begin{aligned} y^1 &= x^1, \\ y^2 &= x^2, \\ y^3 &= u = u^1(x^1,x^2), \\ y^4 &= v = u^2(x^1,x^2), \end{aligned}$$

where u^1, u^2 are single-valued, differentiable real continuous functions of the real parameters x^1, x^2, the surface S_2 has a tangent plane T_0 at every point of S_2. In general, the plane T_0 may take any position in E_4. It is of a special interest, however, if it is isocline with respect to the coordinate plane $\left\{ \begin{matrix} y^3 = 0 \\ y^4 = 0 \end{matrix} \right\}$. This happens if, and only if, either set of the following conditions is satisfied:

$$\left\{ \begin{matrix} \partial_1 u^1 = \partial_2 u^2 \\ \partial_2 u^1 = -\partial_1 u^2 \end{matrix} \right\} \text{or} \quad \left\{ \begin{matrix} \partial_1 u^1 = -\partial_2 u^2 \\ \partial_2 u^1 = \partial_1 u^2 \end{matrix} \right\}.$$

It is interesting furthermore, that an S_2 that possesses an isocline tangent plane at every point P of S_2 is a very special one, namely a minimal surface.

While many of the theorems of functional analysis require the definition and technique of the power series expansion in complex terms and that of the integral of complex functions, the geometrical method followed can dispense with them. By this way, for instance, the identity theorem of analytic functions is a consequence of the fact that two minimal surfaces may intersect each other in isolated points only, or if they intersect along an arc of a continuous curve, then they coincide identically. Furthermore, since the coordinate planes are also minimal surfaces, an analytic function may have only a finite number of zeros in every closed region. These and others such as the maximum modulus theorem, are proven using geometrical considerations prior to the definition of complex integral and without series expansion in complex terms.

In the final chapter, the geometrical equivalent of the problem of analytic continuation of complex functions is treated with moderate success. The geometrical problem in this case is to find a minimal surface in E_4 passing through a given curve C of E_4.

Microfilm $2.00; Xerox $5.00. 99 pages.

SPECIAL HOMEOMORPHISMS IN THE FUNCTIONAL SPACE $C(X,I_{2n+1})$

(L. C. Card No. Mic 59-1008)

Arthur L. Gropen, Ph.D.
Duke University, 1958

Supervisor: John H. Roberts

The present investigation grew from an attempt to generalize a result obtained by J. H. Roberts. This result states the following: "If the separable metric space M has dimension n, n finite, then there is a homeomorphism f of M into Euclidean 2n+1-space, E_{2n+1}, such that for any

k-dimensional hyperplane R_k in E_{2n+1} $(n+1 \leq k \leq 2n+1)$ we have $\dim(f(M) \cap R_k) \leq k-n-1$." In the proof of this statement M is first embedded in a compact space M* of dimension n and then the desired homeomorphism f is found on this compact space. Roberts' proof shows, though the statement does not appear in the theorem, that the set of such homeomorphisms f is a dense G_δ in the functional space $C(M^*, E_{2n+1})$ of all mappings of this compact space into E_{2n+1}.

The question arises as to the existence of such a dense G_δ of homeomorphisms on the original non-compact space M. We prove the following result: Let M be a separable metric space of dimension n and let $(T_n^j)_{j=1}^\infty$ be an arbitrary countable family of n-dimensional hyperplanes in the Euclidean cube I_{2n+1}. Then the set of all mappings f from M into I_{2n+1} with the following properties contains a dense G_δ in the functional space $C(M, I_{2n+1})$: 1) for every k-dimensional hyperplane T_k in I_{2n+1} $(n+1 \leq k \leq 2n+1)$ we have $\dim(f(M) \cap T_k) \leq k-n-1$. 2) f is a homeomorphism from M into I_{2n+1}. 3) for all $j=1,2,\ldots$, the set $f(M) \cap T_n^j$ is empty.

We make special use of this result in the problem of extensions of mappings. Specifically, we show that if f is a mapping from a closed subset A of a separable metric space X into I_{2n+1}, $\dim(X-A) = n$, and $(T_n^j)_{j=1}^\infty$ is an arbitrary countable family of n-dimensional hyperplanes in I_{2n+1}, then f can be extended to a mapping F over X such that the restriction of F to X-A has the intersection properties 1) and 3) above and also, for every $\epsilon > 0$, the restriction of F to $[X-S(A,\epsilon)]$ is a homeomorphism. Further, the set of such extensions F contains a dense G_δ in the space of all extensions of f over X.

A result of M. K. Fort, Jr. states the following: "If X is m-dimensional, $m \geq n$, and f is a mapping of a closed subset A of X into I_n, then there exists a continuous extension F of f over X such that F is of type m-n on X-A. (i.e. if y is any point of F(X), then $\dim(F^{-1}(y) \cap (X-A)) \leq m-n$)." We generalise this result slightly in the following corollary: Let X be an arbitrary separable metric space and let A be a closed subset of X such that $\dim(X-A) = m$. Then if f is a mapping from A into I_n there exists an extension F of f over X such that F is of type m-n on X-A. Further, the set of such extensions is dense in the space of all extensions of f over X.

Microfilm $2.00; Xerox $3.00. 28 pages.

ON THE CONSTRUCTION OF CERTAIN AUTOMORPHIC FORMS OF NON-NEGATIVE DIMENSION

(L. C. Card No. Mic 59-533)

Marvin Isadore Knopp, Ph.D.
University of Illinois. 1958

Rademacher and Zuckerman have given the Fourier expansions for modular forms of positive dimension, r, and principal part $\alpha_{-\mu} e^{-2\pi i \mu \tau} + \cdots + \alpha_{-1} e^{-2\pi i \tau}$. The Fourier coefficients depend upon r and $\alpha_{-1}, \ldots, \alpha_{-\mu}$ as parameters. They are given as linear combinations, depending on $\alpha_{-1}, \ldots, \alpha_{-\mu}$, of complicated infinite series involving Bessel functions and sums related to Kloosterman's sum.

The converse to the Rademacher - Zuckerman result is not true. If one defines a function F simply by writing down a Fourier series of the type given by Rademacher and Zuckerman, with arbitrary positive r and arbitrary $\alpha_{-1}, \ldots, \alpha_{-\mu}$, F may or may not be a modular form of dimension r. The problem is to find criteria by which one may determine, from the series alone, which of the Fourier series so given represent modular forms.

It seems reasonable to expect that any function, F, defined by a Fourier series of the Rademacher - Zuckerman type will behave decently under modular substitutions, whether or not it is a modular form. That this is the case is shown when r is a non-negative even integer. Theorem: If F is such a Fourier series with arbitrary $\alpha_{-1}, \ldots, \alpha_{-\mu}$ and r a non-negative even integer, then $F(\tau) - \tau^r F(-\frac{1}{\tau})$ = polynomial in τ of degree at most r. The method used is an extension of that given by Rademacher [Amer. J. Math. vol. 61 (1939) pp. 237-248].

On the basis of this result, if μ is greater than r/2+1 (this can be improved except when $r \equiv 2 \pmod{12}$ and $r \equiv 10 \pmod{12}$, then $\alpha_{-1}, \ldots, \alpha_{-\mu}$ can be chosen in such a way that $F(\tau)$ is a modular form. The $(\alpha_{-1}, \ldots, \alpha_{-\mu})$ are chosen as a solution to a certain system of r/2 homogeneous linear equations.

Several corollaries and a converse to the above theorem are proved.

Next, Fourier series $F_{\sqrt{\ell}}$ $(\ell = 2,3)$ are given which are invariant under $\tau \to \tau + \sqrt{\ell}$. These are closely related to the series given by Rademacher and Zuckerman and the theorem proved for the latter Fourier series are proved for the $F_{\sqrt{\ell}}$. On the basis of this result, automorphic forms of non-negative even integral dimension are constructed for the groups $G(\sqrt{\ell})$.

Finally, Fourier series, F_2, are given which are invariant under $\tau \to \tau + 2$ and for which a theorem of the above type holds. Again, r is a non-negative even integer. Theorem: $F(\tau) - (2^\tau + 1)^r F(\tau/2\,\tau+1)$ = polynomial in τ of degree at most r. For $\mu = 1$, $r = 0$, $F_2(\tau)$ reduces to $\lambda(\tau)$, and the theorem reduces to $\lambda(\tau/2\,\tau+1) = \lambda(\tau)$, a result well-known in the theory.

Unfortunately, at the present time, it is not clear that this theorem can be used to construct automorphic form of positive even integral dimension for the group G(2).

Microfilm $2.00; Xerox $3.00. 54 pages.

ASYMPTOTIC DISTRIBUTION OF SAMPLE SIZE FOR CERTAIN METHODS OF SEQUENTIAL SAMPLING

(L. C. Card No. Mic 59-342)

Lonnie Louis Lasman, Ph.D.
North Carolina State College, 1958

Supervisor: Evan James Williams

This dissertation is concerned with finding the asymptotic distribution of the sample size required to reach a certain fixed boundary when the sampling is of a sequential nature.

The most general case considered is one with s populations mixed together in the proportions $p_1, p_2, \ldots, p_s$, where $\sum p_i = 1$. Observations are drawn from this mixture

one at a time and can then be classified correctly as to population. If n_i is the number of observations taken from population s, then $n = \sum n_i$ is the total sample size.

A sample path is defined by a sequence of points in s dimensions, each point having integral coordinates, and the coordinate x_i at any given time being the number of observations n_i thus far in the sample. Sampling ceases when the sample path crosses a fixed boundary. The boundary may be chosen so that when it is crossed by the sample path, an estimate with desired properties may then be obtained.

If this boundary is of the form

$$f(x_1, x_2, \ldots, x_s) = 0 , \tag{1}$$

where f has derivatives with respect to $x_1, x_2, \ldots, x_s$, and these derivatives have the same sign, then it is shown that the sample size n, which is a random variable, is asymptotically normally distributed with mean λ and variance

$$\frac{\lambda \sum p_i p_j (f_i - f_j)^2}{(\sum p_i f_i)^2} ,$$

where

$$f_i = \left. \frac{\partial f(x_1, \ldots, x_s)}{\partial x_i} \right| \begin{array}{l} x_i = \lambda p_i \\ j = 1, 2, \ldots, s . \end{array}$$

and λ is defined by

$$f(\lambda p_1, \lambda p_2, \ldots, \lambda p_s) = 0 .$$

Results are also given for a boundary with discontinuous derivatives so not of the form (1). This is for the special case $s=2$, and the rule is: stop sampling when at least m_1 observations from population 1 and at least m_2 observations from population 2 have been drawn.

It is shown that for this case,

$$E(n) = \frac{m_1+m_2}{B(m_1,m_2)} \left[\frac{1}{p_2} \int_0^{p_1} u^{m_1-1}(1-u)^{m_2} du + \frac{1}{p_1} \int_{p_1}^{1} u^{m_1}(1-u)^{m_1-1} du \right]$$

and

$$V(n) = \frac{(m_1+m_2)(m_1+m_2+1)}{B(m_1,m_2)} \left[\frac{1}{p_2^2} \int_0^{p_1} u^{m_1-1}(1-u)^{m_2+1} du + \frac{1}{p_1^2} \int_{p_1}^{1} u^{m_1+1}(1-u)^{m_2-1} du \right] - E(n) .$$

If the boundary is a straight line of the form

$$kx_1 + x_2 = m , \quad k \text{ a positive integer},$$

then the total number of paths to this line for increasing integral values of m was shown to be approximately a geometric progression. For a given slope -k and intercept m, let P(k,m) be this total number of paths.

Then

$$P(k,m) \sim a\, t_1^{\,m}$$

where t_1 is the largest root of

$$t^k - t^{k-1} = 1 \tag{2}$$

and

$$a = \frac{t_1^{\,k}}{k(t_1-1)+1} .$$

Equation (2) results from the fact that

$$P(k,m) = P(k,m-1) + P(k,m-k)$$

which is a type of a linear difference equation and for $k = 2$ gives the Fibonacci sequence. An approximation to t_1 is also considered, and it was found that

$$k^{1/k} < t_1 < \left(\frac{k}{\log k}\right)^{1/k} .$$

Microfilm $2.00; Xerox $3.80. 68 pages.

ON THE GROWTH OF STOCHASTIC PROCESSES

(L. C. Card No. Mic 58-7367)

Albert Waldron Marshall, Ph.D.
University of Washington, 1958

Several generalizations of Chebyshev's inequality are obtained in Chapter I, and their sharpness is investigated (loosely speaking, an inequality is called 'sharp' if it cannot be improved without utilizing more information about the random variables involved).

1. A lower bound for $P\{|X-a| < b\}$ is obtained in terms of the variance of the random variable X which has zero expectation, and an example is given to demonstrate sharpness.
2. An upper bound for $P\{\max_{1 \le k \le n} a_k|X_k| \ge 1\}$ is obtained in terms of $E|X_k|^r$, $k = 1, 2, \ldots, n$, $a_k > 0$, $k = 1,2, \ldots, n$, and $r \ge 1$. Under additional conditions satisfied if $E(X_1) = 0$, an example is given to demonstrate sharpness.
3. Let $X_1, X_2, \ldots, X_n$ be random variables with zero expectations and finite second moments, and let $\epsilon_k > 0$, $k = 1,2, \ldots, n$. Two lower bounds for $P\{|X_k| < \epsilon_k, k = 1,2, \ldots, n\}$ are obtained, one in terms of $E(X_k^2)$ and $E(X_1X_k)$, $k = 1,2, \ldots, n$, and one in terms of $E(X_k^2)$, $k = 1,2, \ldots, n$, and $E(X_{k-1}X_k)$, $k = 2,3, \ldots, n$. In the latter case, conditions are given under which the inequality is sharp.

In Chapter II, some general results concerning separable stochastic processes $\{X_t; t \ge 0\}$ are obtained; these are utilized together with the results of Chapter I to provide lower bounds for $P\left\{\sup_{t \in [0,\tau]} \frac{|X_t|}{f(t)} < 1\right\}$ in two cases. In the first of these, the process is assumed to be a martingale and the bound is in terms of $E\,X_t^{\,r}$, $0 \le t \le \tau$, where $r \ge 1$ is fixed. In the second case, an inequality is obtained for another class of processes which may be applied with certain knowledge of the covariance function $E(X_sX_t)$, $s,t \ge 0$.

In Chapter III, expressions for $P\{X_t \le f(t)$ for all $t \in [0, \tau]\}$ are given, where $\{X_t; t \ge 0\}$ is a separable Poisson process and f is a non-negative function on $[0,\infty]$. For a two parameter family of functions f, this probability is evaluated in terms of tabulated functions, and $P\{X_t \le f(t)$ for all $t \in [0,\infty]\}$ is also obtained. These results are then applied to compound Poisson processes and in particular to Polya processes. Simple expressions for $P\{X_t \le f(t)$ for all $t \in [0, \tau]\}$ are also obtained for certain birth processes and functions f. Microfilm $2.00; Xerox $4.40. 84 pages.

SPECTRAL THEORY OF SELF-ADJOINT ORDINARY DIFFERENTIAL OPERATORS

(L. C. Card No. Mic 59-1475)

Charles C. Oehring, Ph.D.
The University of Tennessee, 1958

Major Professor: F. A. Ficken

Let L be a formally self-adjoint ordinary differential operator with sufficiently smooth complex-valued coefficient functions defined on a (possibly infinite) interval (a, b). Suppose that the coefficient of the highest derivative does not vanish on (a, b). Let r(x) be a bounded, positive, measurable function defined on (a, b), and $\mathcal{H}$ the Hilbert space of complex functions u for which $\int_a^b |u|^2 r\,dx < \infty$. Let T be the largest operator in $\mathcal{H}$ for which $Tu = \frac{1}{r} Lu$ makes sense in $\mathcal{H}$, and T_0 be the adjoint of T. Let H be a self-adjoint extension of T_0 with domain D_H. According to a theorem of von Neumann there exists a continuous direct sum $\tilde{\mathcal{H}}$ of Hilbert spaces which is unitarily equivalent to $\mathcal{H}$ and in which H assumes a diagonal form. If $u \in D_H$, the variation of parameters formula may be used to find a kernel $f_x(y)$ such that u(x) may be expressed in the form $u(x) = \int_a^b \overline{f_x(y)}\,(Hu)(y)\,dy$. Translated into $\tilde{\mathcal{H}}$, this formula yields an expansion of u which is closely related to the usual eigenfunction expansion. An inversion formula is derived by a Fubini argument. Both formulas are then extended to all $u \in \mathcal{H}$. The usual expansion theorem, together with explicit formulas for H and its resolution of unity, are then derived by a change of measure.

A theorem of Coddington concerning boundary conditions associated with differential operators is extended to symmetric operators in an abstract Hilbert space.

Finally, there is generalized to arbitrary closed symmetric operators with equal positive defect numbers a result of Hartman and Wintner asserting that every real point in the complement of the essential spectrum of a real second-order differential operator is an eigenvalue of some self-adjoint extension.

Microfilm $2.00; Xerox $3.80. 68 pages.

CONVERGENT SEQUENCES OF COMPLETE THEORIES

(L. C. Card No. Mic 58-7887)

Dana Scott, Ph.D.
Princeton University, 1958

A general logical principle is proved about the satisfiability of formulas of the first-order predicate calculus containing at most n variables. Applying the principle to geometry it is shown that a first-order formula with at most n variables is true in Euclidean geometry of dimension n - 1 if and only if it is true in all higher dimensions. As a consequence, infinite dimensional Euclidean Spaces are indistinguishable by first-order properties. Applying the principle to equivalence relations, a new proof of the decidability of the first-order theory of one equivalence relation is obtained as a corollary. The method has the advantages of being combinatorial and model-theoretic and not requiring the reduction of formulas to any kind of normal form. Similar applications to a few other simple theories are presented.

Microfilm $2.00; Xerox $4.00. 71 pages.

SOME THEOREMS ON EQUICONTINUITY AND RETRACTION

(L. C. Card No. Mic 59-1414)

Daniel Sokolowsky, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor L. C. Young

Several well known theorems in surface area theory, first developed for continuous mappings (T,J) from a 2-cell J in the Euclidean plane E_2 are shown here to apply to more general situations. If J is a simple Jordan region with boundary J*, and G(T,J) denotes the collection of maximal continua of constancy of the mapping (T,J), then the mapping has been called base if the following two conditions held: (a) $E_2 - g$ is connected for every $g \in G(T,J)$; (b) no continuum $g \in G(T,J)$ covers J. A mapping (T,J) has been called open non-degenerate when the following two conditions held: (c) J-g is connected for every $g \in G(T,J)$; (d) no $g \in G(T,J)$ covers J*. In terms of these classifications, the following theorems have been proven: (1) (E. J. McShane) Any continuous mapping (T,J) not constant on J* has a base retraction (T',J) with T(w) = T'(w) for every $w \in J^*$; (2) (L. Cesari) If C is any given simple closed curve in E_3 and $\epsilon > 0$ any given number, then there exists a number $\delta = \delta(C,\epsilon) > 0$ such that each continuous mapping (T,J) with $\|\theta T, C\| < \delta$ has a retraction (T_0, J) which has a non-degenerate, non-zero boundary, and $\|\theta T_0, C\| < \epsilon$. If T is base, T_0 is open non-degenerate. (Here $\|\ \|$ denotes the Frechet distance.) Both theorems admit of various generalizations in terms of new classifications which are introduced here, in particular, mappings of type-v, of type A_k, B_k $(0 \le k \le 1)$, and of type C. If J is a Jordan region of arbitrary finite connectivity v, and if (T,J) denotes a continuous mapping on J, then (T,J) is called a v-mapping if (a) $J_i^* - g \neq 0$ for every g in the related collection G(T,J). For any set $I \subset J$ let 0(I) = diam T(I). Then we introduce a function $p(\gamma)$, $\gamma \in H$, where $p_i(\gamma) = 0$ if $\gamma J_i^* = 0$ and $p_i(\gamma) = 0(\gamma J_i^*)/0(J_i^*)$ if $\gamma J_i^* \neq 0$, i = 0,1, . . . ,v, and $p(\gamma)$ max $p_i(\gamma)$, i = 0,1, . . . ,v. If (T,J) is a v-mapping, we say T is of type A_k if $p(\gamma) > k$ for every $\gamma \in H$, where H = H(T,J) denotes the entire collection of all components γ of J-g for every $g \in G(T,J)$. Similar definitions of classifications of surfaces of type B_k and C are provided and interrelations between these classifications are studied. In terms of these classifications and an appropriate modification of the concept of retraction, certain generalizations of the preceding theorems are obtained, such as the following: (3) Every c.v-mapping (T,J) possesses a retraction (T_0,J) with respect to some K which is a c.v-mapping of type A_0 and with $\theta T_0 = \theta T$. (Here θT denotes the boundary of T.) (A similar generalization is obtained for theorem (2) above.)

Various theorems on equicontinuity which apply to these types of surfaces are also obtained, such as the

following: (4) If J is a Jordan region of arbitrary finite connectivity, if $[T_n : x_n^i\ x_n^i(u,v), i\ 1,3,3,\ n\ 1,2,..,\ (u,v) \epsilon J]$ is a sequence of D-mappings such that

(i) $D_n(T,J) < M < \infty$, n 1,2,3,... ;

(ii) For every $\epsilon > 0$ there exist $N = N(\epsilon)$, $\delta = \delta(\epsilon) > 0$, such that $0_n(C) \geq \delta$ for any $n \geq N$ and for any cross-cut C of J dividing J into two parts J_1, J_2 with J_1 simply connected for which $0_n(J_1)$, $0_n(J_2) \geq \epsilon$ n = 1,2,... ;

(iii) For every $\epsilon > 0$ sufficiently small there exist $\delta_0 > 0$ and an integer N_0 such that for any cross-cut C of J (as in (ii)) dividing J into two parts, J_1, J_2, J_1 simply connected, diam $C < \delta_0$, $n \geq N_0$, we have $0_n(J_2) \geq \epsilon$,

then $[T_n]$ is equicontinuous in the neighborhood of J*. We show that the region J in this theorem may be replaced by an arbitrary open set of finite connectivity by employing suitable definitions of continuity in the neighborhood of a prime-end. Microfilm $2.00; Xerox $6.40. 133 pages.

MINERALOGY

HEAVY MINERALS IN LOWER TERTIARY FORMATIONS IN THE SANTA CRUZ MOUNTAINS, CALIFORNIA

(L. C. Card No. Mic 59-1435)

Alexander James Beveridge, Ph.D.
Stanford University, 1959

Supervisor: C. O. Hutton

A total of 44 heavy minerals are described from the Butano (Eocene), San Lorenzo (Oligocene) and Vaqueros (Miocene) formations in the Santa Cruz mountains, but of these, only 14 occur in appreciable amounts. They are: apatite, biotite, chlorite, clinozoisite, epidote, garnet, hematite, ilmenite, leucoxene-anatase, magnetite, rutile, sphene, tourmaline and zircon.

Stratigraphic variations of mineral frequencies in the Butano and Vaqueros formations are significant through both vertical and horizontal intervals. The San Lorenzo formation is dominantly shale and it was believed that the percentages of heavy minerals therein would be too low to allow detailed study. The mineral variations in the Butano and Vaqueros sands are attributed to four main processes: (1) differential sorting, (2) concentration of stable minerals by removal of unstable species, (3) diagenetic alteration and (4) changes in intensity of erosion and weathering at the source, plus changes in mode of transport to the site of deposition.

Diagenesis, which plays an important role in the alteration of ilmenite and sphene to leucoxene (or anatase), appears to have been more active in the northernmost sections of these formations, where increased distance from shore and source of sediments may have been a controlling factor in mineral alterations.

The main distributive province, from which the heavy minerals of these lower Tertiary sedimentary rocks were derived, is the area in which the Ben Lomond quartz diorite and adjacent metamorphic rocks occur. A secondary terrane, which appears to have made a minor but significant contribution to eary Tertiary sedimentation in this area, is the Pre-Tertiary (Franciscan) sedimentary, metamorphic and basic igneous terrane, northeast of the San Andreas fault. Microfilm $2.00; Xerox $5.80. 119 pages.

THE RELATIONSHIPS AMONG SELECTED MINERALS, TRACE ELEMENTS AND ORGANIC CONSTITUENTS OF SEVERAL BLACK SHALES

(L. C. Card No. Mic 59-778)

Erwin O. Strahl, Ph.D.
The Pennsylvania State University, 1958

The relationships between and among the mineral, organic, and trace element constituents of samples of the Chattanooga and the Ohio shales in the United States, the St. Hippolyte of France, and the Alum shale of Sweden have been investigated and discussed in terms of the geochemical environments. The relative importance of the environmental factors was evaluated.

A total of 280 samples were analyzed for total carbon, organic carbon, aliphatic and aromatic hydrocarbon, carbonate, total iron, iron oxides, pyrite, total silicates, quartz, kaolinite, illite, amorphous silicates, uranium, molybdenum, manganese, and quartz grain size.

The methods for the analysis of the hydrocarbons, the silicate minerals and molybdenum and manganese were developed or improved by the writer in order that suitable quantitative data could be obtained.

The amounts of aromatic and aliphatic hydrocarbons obtainable from a shale by CS_2 extraction were determined by nuclear magnetic resonance spectroscopy.

The amounts of quartz, kaolinite, illite, and amorphous silicates were determined by first roasting and acid leaching the samples and then obtaining x-ray diffractometer tracings.

The molybdenum and manganese were quantitatively determined by using a method which combined the advantages of solution - spark and mutual standard emission spectroscopy.

The data obtained were analyzed using correlation and factor analysis statistics.

The more important relationships made obvious by this investigation are as follows:

Pyrite, organic carbon, and uranium vary together in the shales studied and depend upon reducing conditions for their concentration.

Molybdenum and manganese co-precipitate in an environment characterized by the presence of carbonate

minerals. The presence of carbonate is a reflection of the oxidative environment necessary to precipitate these elements.

In a highly reducing environment, organic carbon and carbonate are incompatable but in a more oxidizing environment the enrichment in organic carbon is paralleled by an enrichment in carbonate.

In the marine shales investigated, the amount of illite relative to the amount of kaolinite is much greater than in the continental shale.

A well defined negative relationship between illite and amorphous silicates in the marine shales, and a poorly defined negative relationship between kaolinite and amorphous silicates in the continental shale, was found. In both the marine and continental shales, such relationships are considered to be a function of the rate of deposition.

As the amount of quartz in the sediment increases, the maximum quartz grain size also increases, but the increase in grain size for a given increase in amount is more rapid in the continental shale than in the marine shales.

The redox environment is the most important factor in the deposition of black shales. The rate of deposition appears to be highly interrelated with the redox environment in those cases where the rate of deposition was relatively rapid.

As shown by the relationship of aliphatic to organic carbon, the organic material is uniform in character in the bituminous shales and somewhat more variable in the carbonaceous shales.

On the basis of this study, it is concluded that the compositions of the shales investigated are highly dependent on the geological factors of environment. The redox potential; the nature of the basin of deposition, marine or continental; and the rate of deposition apparently control the mineralogical and chemical compositions of the black shales. The nature of the organic material, bituminous or carbonaceous, appears to be related to both the type of material available and to the oxidation of the sediment during deposition.

These geological factors are interrelated and the composition of a shale is the result of the joint action of these factors during deposition.

Microfilm $2.15; Xerox $7.60. 164 pages.

MUSIC

PYKNON OVERTURE FOR ORCHESTRA AND STRING QUARTET NO. I

(L. C. Card No. Mic 58-3936)

Thomas Jefferson Anderson, Jr., Ph.D.
State University of Iowa, 1958

Chairman: Professor Philip T. Bezanson

Pyknon Overture

The artist of today can no longer live in blessed ignorance of all that happens about him. These things have their relationship to the composed works. The result is a composition based upon thought and earnest study.

The Pyknon Overture for Orchestra is a work constructed in a manner similar to that of the sonata form. The composition was done without programmatic interest. The work's thematic material and rhythmic force belong to our own time.

For performance, the overture requires one piccolo, two flutes, two oboes, two clarinets in B^b, two bassoons, four horns in F, three trumpets in B^b, three trombones, tuba, tympani, percussion and the usual string family.

A brief introduction, which presents a dialogue between the lower string section and a woodwind trio, leads into the Allegro where the principal subject makes its entrance. The notes F, $F^\#$ and G assume importance here. The flute introduces the second subject, which is followed by a development section. Again, the notes F, $F^\#$ and G appear: this time in the lowest voice of the brass ensemble. In the recapitulation, the principal subject appears in a manner similar to that in the Allegro. A statement of the second subject follows and brings the recapitulation to an end. A short coda ensues and the notes of density resolve on the note A^b.

Pyknon, the Greek word referring to density, is significant. The title was chosen after completion of the score. In the overture, the points of density represent two chromatic half steps. The title, therefore, has direct application to the orchestral work.

String Quartet No. I

The String Quartet No. I has three contrasting movements. The first, Allegro, begins with the first violin introducing the main subject after a one measure introduction. The mood changes. There is a short development section followed by a recapitulation with the original violin theme in the cello. The beginning of the coda is marked by the appearance of the ostinato. The first movement is characterized by a restrained vigor and a texture of flowing stillness.

The Adagio movement is marked by a tranquil and, at times, rhapsodic mood. It is rich in sonority. At the beginning, a unison idea gives way to fragmentary motives. The ternary form starts with a lyric theme in the viola. The melodic theme is passed around to the different instruments of the quartet. In a contrasting section, the tempo is increased and the texture thickens. The theme of the first section then returns in the second violin. The continuance of the E^b tonic pedal, introduced earlier, closes the movement.

The core of the third movement appears in the introduction. After the introduction, the movement becomes highly rhythmic in nature with syncopated themes. This rhythmic idea, first expressed in the introduction, begins at the tempo frettoloso. The second theme, which is

derived from the introduction, appears in the second violin. The development starts in a slow contemplative mood and leads to a false recapitulation. A full statement by all the instruments ensues. The second theme returns in the viola. This theme is treated imitatively in the coda with the rhythmic accompaniment of the first theme. A free canon closes the movement.

Microfilm $2.00; Xerox $4.40. 82 pages.

MUSIC FOR THE EDUCABLE MENTALLY RETARDED

(L. C. Card No. Mic 59-751)

Margaretta Adelaide Carey, Ed.D.
The Pennsylvania State University, 1958

Statement of the Problem

The basic question was: What experiences in music education are effective and profitable for the educable mentally retarded children in the public schools? The choice of experiences and materials was considered in terms of social maturation, emotional and creative expression, personal satisfaction, and physical development. Four subordinate problems are enumerated in the presentation of the findings.

Procedure

A survey was made of all cities in the United States with populations of 25,000 or over to determine the status of music curricula for the educable mentally retarded. Nine field situations were established in the northern part of Illinois. Included in the nine groups of educable mentally retarded were two primary, five intermediate, and two junior high levels.

These children experienced singing, listening, rhythms, creativity, and the playing of percussion instruments under the direction of the researcher and the regular classroom teacher for a period of four months. During that time various methods and wide varieties of materials were used.

The progress of each child in the fields of listening, singing, body rhythms, and playing rhythm instruments was recorded on achievement and attitude sheets which were constructed for the study. The ratings for each child were determined by the regular classroom teacher and the music teacher.

Conclusions

The answers to the four subordinate problems are as follows:

1. Music was included as a regular part of the curriculum for the educable mentally retarded children in four hundred fifty-eight of the four hundred sixty-five cities which participated in the study.
2. The survey disclosed that the same methods are used for teaching music to the mentally retarded children as are used for the normal children but the pace of teaching is slower and more repetition is used.
3. Any proposed music curriculum must be extremely practical. The music experiences should include rote singing, listening, free and controlled rhythmic activities, creativity, and playing percussion instruments.
4. Those methods which deal with concrete experiences and in which there is much repetition are the most effective. Careful explanation, simplicity of presentation, and demonstrations are essential to successful teaching of the educable mentally retarded.

Those musical experiences which are effective for the educable mentally retarded children on a short term basis are singing, listening, and controlled rhythmic activities. Those which are effective over a longer period of time are free rhythmic activities, creativity, and playing percussion and melody instruments.

It was found that the educable mentally retarded children responded to the musical activities and progressed at the same rate in music as they seemed to progress in academic studies. Because music can play such a vital part in emotional and creative expression, enjoyment, personal satisfaction, and physical development, it should be an integral part of the curriculum for the educable mentally retarded. Microfilm $2.00; Xerox $5.00. 97 pages.

AN ENSEMBLE METHOD FOR TEACHING PERCUSSION INSTRUMENTS

(L. C. Card No. Mic 59-1089)

Edward Henry Cleino, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Irving Wolfe

The purpose of this study was to develop a method which could be used to prepare school percussionists to be effective members of bands and orchestras. From comments of band directors and others in the field it was apparent that there is great need for improvement of instruction in this area. Since many instrumental instructors are not well prepared in percussions themselves, it is all the more important for them to have effective tools to assist them in their teaching.

Band and orchestra directors have a minimum of time at their disposal for class instruction; it is therefore imperative that this time be used wisely if the students are to develop to the fullest extent possible within the school program.

As a background for the study the three types of instrumental class instruction used in schools (heterogeneous, families of instruments, and like instrument classes) were examined for their potential in the teaching of percussion instruments. Twenty-two of the more frequently used snare drum methods were analyzed and evaluated, and recommendations were made for their use. Three hundred snare drum scores were analyzed to determine the extent to which the drum rudiments, other than rolls, were used in typical band and orchestra literature.

Findings of the Study

The ensemble method which was developed provides experiences for students of beginning snare drum, for a

more advanced group of snare drum students and for beginning students of tympani, to be taught simultaneously. Each of these three groups is provided a score of 44 lessons appropriate to their own instrument and stage of development. The method makes extensive use of musical compositions. There are 21 long and 28 short compositions included, in addition to applications at the close of each lesson of drill. The compositions comprise about three-fourths of the ensemble method. This extensive use of compositions will assist the student in learning to listen, to read, to interpret musical phrases, to develop musicianship.

In order that the rudiments might be included in a realistic manner, an analysis of 300 snare drum scores was made to determine the extent to which drum rudiments were used. In contrast with the 26 drum rudiments taught in many snare drum methods, only four rudiments (other than rolls) were found in more than 15 per cent of the compositions analyzed. In order of decreasing frequency they were the flam, ruff, paradiddle, and four stroke ruff. A second group of five rudiments, related to the above appeared in 3.33 per cent to 5.33 per cent of the compositions. They were the double paradiddle, flam accents one and two, flam tap, and the single ratamacue. Isolated examples of six of the balance of the riduments were found five or less times in the 300 compositions analyzed, and no rhythms were found in which five of the rudiments could be applied.

This method which was developed provides for percussions the ensemble approach which has long proven beneficial to classes of brass, woodwind, and string students. Teachers need not be percussion specialists in order to successfully use this material. Percussion students prepared by this method should become more effective members of school bands and orchestras.

Microfilm $2.50; Xerox $8.80. 192 pages.

WOLFGANG AMADEUS MOZART: THE WORKS AND INFLUENCES OF HIS FIRST TEN YEARS

(L. C. Card No. Mic 58-7914)

Dominique-René de Lerma, Ph.D.
Indiana University, 1958

Musical and biographical references to Mozart are numerous, but almost every source makes only brief and cursory references to his youth. These first years show the preliminary manifestations of Mozart's genius and witness his remarkable ability to absorb and remodel those technical elements found in the music which he came to know of the older generation. The major study of Mozart's music and influences is that by Wyzewa and Saint-Foix, but their efforts are not totally valid. Several sources which were available to them were not properly examined, particularly the two notebooks of 1759 and 1762. As a result, they reach conclusions which more complete investigation renders untenable. It is claimed, for example, that Wolfgang first encountered the Alberti bass in Augsburg, and the menuet with trio in Vienna, but both were known to him before he left Salzburg. Moreover, in the light of recent discoveries, their study becomes partially outdated, for they did not have access to Mozart's initial essays, nor were they then able to consider the London four-hand sonata.

Wolfgang began his study of music on the clavier from the notebook his father, Leopold, had given his sister in 1759. It is only natural that the boy, when he began composing his own little menuets, followed the melodic, harmonic and formal language of this notebook, under the guidance of his father. In 1762, honoring his Saint's Day, a notebook of his own was given Wolfgang. This anthology of songs and keyboard dances provided him with more advanced practice material, but showed him a greater variety of musical thought, introducing him to some small pieces by Hasse, K. P. E. Bach, Handel, Hurlebusch and others.

After short trips to Munich and Vienna, Leopold took his family on a long tour of western Europe. At the start of this three-year journey, Wolfgang was a precocious performer with less than a dozen short keyboard compositions to his credit. On his return to Salzburg, he had created about fifty new works, more ambitious in form, treatment and medium. Aside from the effect on his musical thinking which resulted from contact with various court orchestras and performers, his meeting Johann Schobert and Johann Christian Bach stands out in greatest relief. Perhaps for the first time he saw the dramatic and expressive powers of music in the works of Schobert, while Bach, by his italianate grace and charm, provided Mozart with a contrasting viewpoint.

Examination of Mozart's music of these years shows the effect of these contacts, but it is evident that the role of influence, especially to the degree claimed by Wyzewa and Saint-Foix, was merely a substitute for formal training, a stimulus toward originality rather than a limitation.

Microfilm $4.25; Xerox $14.40. 331 pages.

THE YOUTH EDUCATION ACTIVITIES OF THE NASHVILLE SYMPHONY ASSOCIATION

(L. C. Card No. Mic 59-1097)

Solie Fott, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: C. B. Hunt, Jr.

The purpose of this study was to trace the development of the youth education activities of the Nashville Symphony Association and to investigate their effect on the musical taste of children. These activities have expanded greatly during the association's twelve-year existence. In the 1957-1958 season fifty-two programs were presented to young people by the Nashville Symphony and four smaller groups from its ranks, the twenty-four member Nashville Symphonette, the Brass Sextet, the Woodwind Quintet, and the String Quartet. In addition the Nashville Youth Orchestra provided training and experience for some sixty young instrumentalists.

In order to study the effects which these programs have on musical taste a suitable measuring instrument was constructed. In contained twenty-one items, consisting of seven musical fragments each of three levels, defined as great, moderate, and little intrinsic musical worth. These

items had been so judged by a group of music educators and professional musicians from an original list of one hundred musical excerpts. This test was administered to children in the Nashville Public Schools. They were asked to respond to each musical fragment on a five point scale, indicating the degree of their liking. The instrument was administered to an experimental group before it attended a program and again afterward. A control group consisting of children who did not hear the program also received the tests. The difference in change between the two groups could thus be attributed to the experimental group having attended the concert. A desirable change could be evidenced by an increase in liking for music of great musical worth or in a decrease in liking for music of little worth.

The data were studied through analysis of variance using three experimental designs, one to study the effects of two Nashville Symphony concerts on sixth grade students, one those of a symphonette program on grades seven through twelve, and one those of a program by one of the three smaller ensembles on grades four, five, and six.

The results were predominantly negative. Only the seventh graders attending the symphonette concert showed a desirable change, evidenced by a significant increase in liking for music of great intrinsic worth. It was evident that the musical taste of all the grades was not good. Their relative liking for the three musical levels was in the reverse order of that to be desired.

The results should not be regarded as a complete refutation of the effectiveness of these activities. The elevation of musical taste is only one factor in musical development. Furthermore, the testing covered only one season's activities, so the absence of significant change does not preclude one over a period of years.

It would seem that the musical taste of children is formed by their daily exposure to a low level of commercial music on radio, television, and the juke-box. One or two symphony concerts cannot suffice to engender a tolerance, much less a liking, for good music. An increase in the number of programs which children attend is certainly necessary. However, much more must be done in the individual school and classroom. Ideally, these concerts should be part of a school year filled with desirable musical experiences.

A capacity to respond to good music is latent in virtually every child, and it can be developed until it becomes an avidity. This should be a paramount goal of a community music organization such as the Nashville Symphony Association. Together with the home and the school it has an urgent obligation to nurture in children a feeling for the life-long enjoyment good music can give them.

Microfilm $2.00; Xerox $5.60. 112 pages.

CONCERTO FOR BRASS, STRINGS, AND TIMPANI

(L. C. Card No. Mic 58-5826)

John Robert Hanson, Ph.D.
State University of Iowa, 1958

Chairman: Associate Professor Philip T. Bezanson

The Concerto for Brass, Strings, and Timpani in a concerto grosso incorporating the symphonic brass section and a full complement of strings. The timpani are used mainly to reinforce brass or tutti passages but assert themselves in occasional solos. Varying roles of solo and accompaniment are assumed by the brass and strings and frequently they are used as full sections in direct contrast to each other. The composition follows a traditional three-movement tempo scheme of Allegro--Lento--Allegro vivace.

Three main sections make up the first movement. It begins with a ritornello-like tutti which states material to be used throughout the first main section. The material undergoes development and expansion which reaches a climax in bar 64. The second main section begins in bar 80 with a contrast in tempo and mood. The construction of this section is similar to that of the first in that the material is being subjected to continuous development. This development leads to a restatement of the opening tutti in bar 166. The third main section consists of a reworking of the material of the first, and the movement closes with a third statement of the tutti.

The second movement is also basically a three-part form. In the first section the solo violin presents the theme over a chordal ostinato based on a C pedal-point. The middle section is a constant rise to a climactic brass passage at bar 58. This is followed by a shortened return which reestablishes the opening mood.

The final movement is constructed in a kind of arch-form and incorporates the sonata-rondo principle. A slower middle episode, which reflects somewhat upon second movement material, replaces the usual development section. In the restatement, the first two episodes are shortened and appear in reverse order.

Formal structure in each movement is dependent upon tonal considerations. The first movement begins in F and rises to B to close the first section. This rise continues in the middle section until F-sharp is reached. This becomes the upper leading-tone in preparation for the return to F in bar 166. The second movement begins with a pedal-point on C, and rises to F at bar 58. The C returns to conclude the movement. The final movement begins in F and moves to a strong cadence on C at bar 56. The middle episode begins in F-sharp and the return at 174 is again in F. Microfilm $2.00; Xerox $5.20. 105 pages.

THE CHORAL WORKS OF ARTHUR HONEGGER

(L. C. Card No. Mic 59-1372)

Herrold Eugene Headley, Ph.D.
North Texas State College, 1959

Arthur Honegger (1892-1955) appeared on the scene at a time when a revolution was taking place in the music world. He, himself, was caught up with the new trends becoming involved in the activities of a group of young French composers who were named "Les Six" by the Parisian critic Henri Collett in 1920. This group, for a time at least, became a symbol of the new musical art; and three of the group: Honegger, Milhaud and Poulenc, came to be among the outstanding French composers of the twentieth century.

This study is concerned with the choral works of Honegger--the large works for chorus, orchestra and solo

voices. Chapter one deals with Honegger's musical heritage--the romanticism of the nineteenth century, the forces which brought it about, the Germantic influences, romanticism in France and the conditions which developed in music prior to the turn of the twentieth century.

Chapter two is mainly biographical, but points up especially the influences on Honegger's life and musical style. Although his musical education began in Zurich, he must be considered a French composer, for he lived almost his entire life in France, was largely trained at the Paris Conservatory and, as a result, came under the influence of the outstanding Fench artists, writers and musicians of the time, first, through his association with the Nouveaux Jeunes, a group of young creative artists whose purpose it was to give expression to their creations and to gain stimulation from the mutual association. Later, Les Six were to create an international stir through their activities and compositions. However, the group was never a "school" in the usual sense, and the various members very soon began to develop in their individual ways. From these men a new style developed in France and Honegger played no small part in its development.

Chapter three deals with the pertinent facts concerning the composition and early performances of the choral works. Special consideration is given to the creation of King David, the work which hurled Honegger to world-wide fame, and to the Jorat Theatre where it was first performed. This theatre is significant in-so-much-as four of Honegger's works had their premiere there, and being a people's theatre, which was largely dependent upon amateur performers, the circumstances affected to a great degree the instrumentation and general treatment of the works.

The subject matter and the texts of the works are treated in chapter four. The eleven choral works being considered fall conveniently into four subject classifications: Sacred, Mythological, Historical and Contemporary. The texts have been examined from the standpoint of the historical and mythological background where applicable, the sources and general organization. In the case of King David, it is shown where the poetry of René Morax was greatly influenced by the French Psalter of the sixteenth century.

Chapter five is a study of the works in question from the standpoint of the structural and stylistic aspects of the music. The compositions are here grouped as: oratorio, cantata, opera, music for the ballet and melodrama and are examined as to the following points: the larger forms, the general function of the chorus in Honegger's music, the smaller forms, two and three part construction and other form and textural treatments, use of the leitmotif, the chorale and borrowed melodies, the narrator, melodic and tonal resources, Honegger's use of melody and harmony, and the relation between harmony and melody in the music.

Microfilm $3.85; Xerox $13.00. 297 pages.

A PERFORMANCE EDITION AND STUDY OF FIVE SACRED CHORAL CANTATAS BY SELECTED GERMAN COMPOSERS (ca. 1650-1720)

(L. C. Card No. Mic 58-3937)

Stephen Gilbert Hobson, Ph.D.
State University of Iowa, 1958

Chairman: Professor Herald I. Stark

In his biography of Johann Sebastian Bach, Dr. Albert Schweitzer states that "the way from Schütz to Bach goes over hills, not mountains." While few students of the history of music would oppose this viewpoint, the present study supports the conviction that those composers who have achieved greatness throughout the history of music have done so, in part at least, upon the basis of stylistic innovations made by their less illustrious predecessors.

The purpose of this study has been to render into practical form some of these precursory compositions which have existed for may years in historical editions, but which have lain dormant there and generally unavailable for performance. Part One consists of a general investigation of the historical background which led from early seventeenth-century monodic forms in Italy to the eighteenth-century German choral cantata. Part Two contains the complete scores of five compositions employing soloists, chorus, and instruments. These works stand as representative examples of the chorale and dramatic concertato types of composition which led to the development of the sacred choral cantata as an important vocal form of the Baroque era. Also included in this section is a discussion of the problems involved in the editing and performance of these works.

The German sacred choral cantata represents an amalgamation of numerous styles and forms that existed in the seventeenth century. During the course of its development, there took place (1) a transplanting of Gabrieli's Catholic Italian concertato style to Schütz's Protestant Germany where it grew to a state surpassing perhaps even Gabrieli's imaginative creations; (2) a fusion of the secular monodic forms with the sacred concertato structures that had become important parts of the Lutheran service; (3) the unification of a distinct instrumental style with vocal choral and solo styles; and (4) the development of texts that dealt with sacred subjects expressed in new poetic paraphrases rather than in strict Biblical quotations.

In Germany the grand concertato style, with its contrasting vocal and instrumental tone colors, echo effects, and towering structure, became the basis of two distinct streams of sacred musical composition: (1) the chorale concertato, based on the somewhat rigid chorale tunes and texts which were familiar to the congregation, and (2) the dramatic concertato, composed at first to Biblical texts, and later to poetic paraphrases, which gave complete freedom to the imagination of the composer. The former became multipartite in structure early in its development owing to the verse structure of the text. The latter remained continuous in structure until the poetically paraphrased texts began to appear and the monodic forms were adopted from the secular chamber cantata and opera. From these elements, all of which were present in German church music by the year 1700, came the "cantata," which, as a product of the eighteenth century, became known

primarily as a sacred composition for solo, chorus, and orchestra in several movements.

The five works examined and edited in the present study are presented as a contribution to the understanding of this significant period in musical history. They are:

Christoph Bernhard: (1627-1692)	Wahrlich, wahrlich, ich sage euch (Truly, truly, I say unto you)
Sebastian Knüpfer: (1632-1676)	Was mein Gott will (What my God wills)
Johann Schelle: (1648-1701)	Barmherzig und gnädig ist der Herr (Compassionate and gracious is the Lord)
Johann Philipp Krieger: (1649-1725)	Singet dem Herrn, ein neues Lied (Sing to the Lord, a new song)
Johann Kuhnau: (1660-1722)	Wie schön leuchtet der Morgenstern (How bright appears the Morning Star)

As an integral portion of this doctoral study in Music Literature and Performance, these five works were prepared and presented in a public performance on December 14, 1956 by the University Chamber Singers and a group of instrumentalists, under the direction of the author.

Microfilm $3.55; Xerox $12.00. 275 pages.

EMERGING CONCEPTS OF MUSIC SUPERVISION

(L. C. Card No. Mic 59-1103)

Arthur F. Humphreys, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Irving Wolfe

The purpose of this research project was to determine the concepts emerging within educational and music supervision, to ascertain and describe the characteristics of supervisory programs influenced by such concepts, and to discover and list the techniques of such music supervision. A survey of the literature of supervision provided background for the characterizations of a supervisory program which has been influenced by such emerging concepts and of the supervisor and the classroom teacher working therein. It also made possible an interpretation of these supervisory concepts in the area of music education, and the construction of a set of suggested criteria for music supervision. Finally, nine music supervisory programs in operation were selected to provide descriptions of outstanding examples of supervisory techniques inspired by such concepts.

For convenience, those concepts which appear to be emerging within music supervision have been identified in this research project as "cooperative-democratic concepts of supervision." Likewise, the distinctive kind of supervision which such concepts have produced has been identified as "cooperative-democratic music supervision."

Those concepts which appear to be emerging within music supervision, particularly at the elementary level, were found to be products of one basic idea. This involves the recognition of all staff members, including capable and interested lay people, as partners in the task of effecting improvement in the music learning situation, and culminates in the acceptance of each partner as valuable to the music supervisory program because of his own potential. Obviously, successful operation of music supervisory programs holding such ideas demands belief in and acceptance of such a concept by all members of the staff. Major by-products of such thinking are the recognition that individual differences in music teaching capacities and development exist among staff members, that the value of a staff member to the group at any one moment is always determined by his contribution-potential at that instant, and that such potential is affected for good or bad by forces at work within that person's environment. Thus, efforts to develop contribution-potential recieve emphasis in such music supervisory programs.

Specifically, the above philosophy permits the recognition that certain staff members within a music supervisory program may be able to perform the tasks of music teaching with comparative ease. Likewise, it permits recognition that other staff members may have difficulty even with the teaching of the simplest songs or the easiest of rhythm patterns.

The existence of such diverse music teaching capacities, however, is not considered a problem of deficiencies. Rather, the consideration becomes one of potentialities, with each staff member unique because of his own potential for contributing to the improvement of the music learning situation. In an attempt to improve this contribution-potential, then, emphasis is placed upon in-service learning for all staff members. Further, inasmuch as the whole supervisory organization is a cooperative affair, in-service learning becomes a matter of personal responsibility for each member of the staff. Thus, opportunities for learning may be as varied as the number of staff members, and each member, in his own individual way, contributes to the over-all experience.

Attention was directed to the necessity for a thorough understanding of the place, function, and duties of the music specialist and of the classroom teacher. The responsibilities and activities of music supervision are not different simply because democratic concepts operate. Performance at a high level is always necessary regardless of the type of supervision.

The project closed with a statement of implications and recommendations for music education which establishment of cooperative-democratic music supervisory programs would inspire. Microfilm $2.10; Xerox $7.40. 157 pages.

MAGNIFICAT

(L. C. Card No. Mic 58-5835)

Carl James Kittleson, Ph.D.
State University of Iowa, 1958

Chairman: Professor Philip Bezanson

THE TEXT

Luke 1;46-55

My soul doth magnify the Lord,
And my spirit hath rejoiced in God my Saviour.
For he hath regarded the low estate of his handmaiden; for, behold, from hence forth all generations shall call me blessed.
For he that is mighty hath done to me great things; and holy is his name.
And his mercy is on them that fear him from generation to generation.
He hath shewed strength with his arm; he hath scattered the proud in the imagination of their hearts.
He hath put down the mighty from their seats, and exalted them of low degree.
He hath filled the hungry with good things; and the rich he hath sent empty away.
He hath holpen his servant Israel, in remembrance of his mercy.
As he spake to our fathers, to Abraham, and to his seed for ever.

Gloria patri

Glory be to the Father, and to the Son, and to the Holy Ghost. As it was in the beginning, is now and ever shall be; world without end, Amen.

ANALYSIS OF THE MAGNIFICAT

The work is scored for solo soprano, mixed chorus, and an orchestra consisting of the following:

2 Flutes	Bass Trombone
2 Oboes	Tuba
2 Clarinets in B-flat	Timpani
2 Bassoons	Triangle
4 Horns in F	Cymbals
3 Trumpets in B-flat	Suspended Cymbal
2 Tenor Trombones	Strings.

The text includes, from the Gospel according to St. Luke, Chapter One, verses forty-six through fifty-five, and the Gloria patri, the former as it appears in the Authorized King James Version. The words of Mary, as here recorded, seemed to divide themselves into two principal sections; the first, including verses forty-six through forty-nine, of an intensely personal character, with verse fifty acting as a bridge to the more universal aspect of the second section, verses fifty-one through fifty-five. Accordingly, in the musical setting of the first five verses the solo soprano figures most prominently, with the chorus answering and supporting, while in the last five verses the chorus is predominant.

However, the musical setting was conceived as a continuous movement, rather than as a series of small sections, with a degree of thematic development, both choral and orchestral, providing a unifying factor alongside the sectionalization that is inherent in the text.

The music is tonally oriented, the principal center being "D". In the short orchestral introduction, the oboe melody of measures two and three introduces a bimodality that is characteristic of much of the music, the theme itself being used to frame the first section, through measure forty-five, and reappearing in an expanded form to generate the choral "Amen" which ends the piece.

The choral fugato beginning in measure 136, "He hath shewed strength with his arm," introduces the melodic material that is the basis of much of the second principal section. It is used in a rhythmically altered form beginning in measure 230, "He hath holpen his servant Israel," and again later, in the orchestra, as a bridge to the concluding choral section. Microfilm $2.00; Xerox $4.20. 79 pages.

GIOVANNI MARIA BONONCINI, A CHAPTER IN BAROQUE INSTRUMENTAL MUSIC (WITH SUPPLEMENT)

(L. C. Card No. Mic 59-50)

William Klenz, Ph.D.
The University of North Carolina, 1958

Supervisor: Dr. Glen Haydon

A study of the instrumental music of G. M. Bononcini (1642-1678); the social and cultural atmosphere for which it was produced and its antecedent and contemporary prototypes. A discussion of the general morphology of the Italian sonata da chiesa and sonata da camera before Corelli, and of mid-17th century dance music.

Conclusion: The recognition of Modena and the Este court as a center of a developed instrumental tradition with distinct local features and international connections (France, England), independent of and contributory to that of Bologna. The identification of G. M. Bononcini as the most significant native member of the Este musical establishment; an estimate of his professional and academic importance and some account of his influence on the general evolution of instrumental forms.

Microfilm $7.30; Xerox $25.20. 575 pages.

NICOLAS BERNIER (1665-1734): A STUDY OF THE COMPOSER AND HIS SACRED WORKS

(L. C. Card No. Mic 59-53)

Philip Francis Nelson, Ph.D.
The University of North Carolina, 1958

Supervisor: Glen Haydon

One of the relatively few French composers from Lully to Rameau who apparently did not compose opera or instrumental music was Nicolas Bernier. Although almost unknown today, this composer during his lifetime was highly esteemed and widely respected.

Considerable new information of a biographical nature was uncovered. Birth and death dates verifiable by archival documents have been made available for the first time.

Proof of Bernier's marriage to Marie-Caterine Marais was also located.

A complete list of Bernier's extant compositions includes: forty-five petits motets, eleven grands motets, nine leçons de ténèbres, seven books of secular cantatas - plus Les Nymphes de Diane -, and a few airs divers. Appearing as an appendix to the main body of this study is a Source Index listing all the libraries in which his works are held along with information on all known manuscript and printed sources. Also appended is a facsimile reproduction of the composer's hitherto unknown Principes de Composition.

Examination of the literary references to the music of Nicolas Bernier from the composer's day to the present has provided material which reflects not only opinion regarding Bernier's music, but also the changes in musical taste over a period of two hundred and fifty years. The present writer has attempted to compile, for the interested reader, excerpts from these references.

With respect to the sacred music of Nicolas Bernier, examination has shown that in the genres which he cultivated, petits motets, grands motets, and leçons de ténèbres, the composer took over existing common practices cultivated by his immediate predecessors and did not add significantly to them.

Latix texts, most often from a liturgical source are employed in this music. The leçons de ténèbres are written for solo voice and basse continue, while the petits motets may employ one, two, or three voices with basse continue accompaniment that is occasionally augmented by additional instruments. Only the grands motets employ soloists, orchestra, and choir (SATBB). The presence of this grand choeur forms the principal basis of distinction between the grand and the petit motet.

From the standpoint of formal design Bernier's motets fit the general description given by Pierre Perrin as "un pièce variée de plusieurs chants ou musique liées, mais differentes." The leçons de ténèbres, his only work based on a Gregorian plainchant, adheres very strictly to the well established liturgical model.

Consideration of style features common to all the music under study reveals that the foundation of Bernier's art is two part counterpoint which takes place squarely within the framework of a well defined tonality. Melodic lines are predominantly scalewise with the use of agréments contributing heavily to the overall sense of style. Dissonance treatment is conservative and accurately approximates that described in the composer's Principes. Modulation to nearly related keys is a common occurrence. Cadential formulae are elementary with the authentic form being used most often and in nearly stereotyped fashion.

A Musical Supplement comprising four petits motets, seven grands motets, and nine leçons de ténèbres concludes this study.

Microfilm $12.10; Xerox $43.20. 959 pages.

CRITERIA FOR DEPARTMENTAL SELF-APPRAISAL OF MUSIC TEACHER EDUCATION

(L. C. Card No. Mic 59-1112)

Millard Jerome Newman, Ed.D.
George Peabody College for Teachers, 1958

Major Professor: Irving W. Wolfe

Appraisal is a process both inherent and essential to education. It may take the form of an ongoing activity, or it may be a periodic determination of extent of accomplishment. Some appraisals are imposed by external authority; others are initiated and implemented from within. In any form, appraisal should develop two definite outcomes. It should give an adequate representation of status quo, and it should provide a useful guide for future direction.

This study was concerned with the periodic, internally activated process of self-appraisal. The problem called for the development of criteria for use in such a program by the faculty of a college music department charged with the responsibility of preparing teachers for elementary and secondary schools. The study was limited to the preservice undergraduate responsibilities of the department. Physical and noncurricular factors were considered only as they immediately affect the instructional program.

No attempt was made to develop a quantitative rating system. Many of the standards demand subjective judgments in their application, and the end result of the self-appraisal is intended to be a qualitative indication rather than any sort of ranking or rating.

The first step in the development of the criteria was to collect and organize data and materials dealing with every element of music teacher education. These came from the books and periodicals of general and professional education, from publications about music and music teaching, from bulletins and committee reports of professional societies and institutional associations, from unpublished studies, and from statements of authoritative persons.

The data were then classified in six categories: The Curriculum, Music Theory, Music History and Literature, Musical Performance, Music Education and Student Teaching, and Non-Curricular Factors. Six chapters of the report present the data thus classified. Each chapter was written as a coherent statement of both the underlying philosophy and the concrete objectives of that area of music teacher education.

Criteria were developed from the foregoing. Duplications were eliminated, and possible correlations and integrations within and among subject matter areas were indicated. Each criterion was carefully refined to make it both a concise positive statement of a desirable practice or accomplishment and a significant measure of achievement.

The criteria were organized within the six categories described above. Within each classification, the standards were subdivided into two types of measures. The first, "Organizational and Teaching Practices," includes those physical and administrative factors which bear directly on the efficacy of the instructional program and the organizational factors of the teaching process which are essential to the development of desired attitudes, appreciations, and broad comprehensions. The second, "Student Masteries,"

encompasses the more easily measurable results of the instruction.

The criteria are intended for faculty use within the music department. One chapter of the report suggests a self-appraisal plan adapted from that recommended by the regional accrediting associations.

The instrument offered as the result of this study is much more comprehensive in scope than the only similar one presently available. It considers significant factors of the educative program of the music department from the standpoint of ultimate effect on student knowledge, understanding, and skill. No attempt was made to define minimum acceptable levels of accomplishment. The basic goal of the study was to provide a yardstick which would indicate both extent of progress and necessary future direction toward the recognized goals of music teacher education. Microfilm $3.30; Xerox $11.20. 254 pages.

DEVELOPING INSTRUCTIONAL MATERIALS FOR BEGINNING STUDENTS OF WIND INSTRUMENTS

(L. C. Card No. Mic 59-568)

Glen Williams Riggin, Ed.D.
University of Illinois, 1958

Many years of experience with instructional materials in teaching beginners on wind instruments revealed a need for materials more suited to the pupils. Further examination of materials most frequently used substantiated this need. This thesis, therefore, is directed toward the development of instructional materials to meet the musical needs of the learner. The materials are then developed in the following manner.

Teaching materials are patently an outgrowth of a philosophy of music education. Therefore a philosophy of music education, consistent with the ideals of a democratic society is enunciated. How such a philosophy influences teaching materials received particular emphasis.

Psychological principles are implied in all teaching materials. Principles of learning that are relevant to beginning instruction of wind instruments are then explored and their application to teaching materials given attention.

Finally actual teaching materials are developed that are consistent with the philosophical and psychological principles in the text of the thesis. These materials are written for the $B^{\flat}$ Clarinet but are applicable for all wind instruments. The materials are dictated by musical principles rather than by a logical idea of sequence. No exercise material of an extraneous nature is used. Problems are approached as they naturally arise from musical experiences and are dealt with in musical context. All materials employed are of recognized musical worth and are geared to the musical taste of the young beginner. No tunes, contrived to solve a problem are used. The musical creativeness of the student is the force that motivates the student to learn, rather than manufactured sets of exercises or pieces. Emphasis is given to the role of singing and rhythmic body movements in the teaching of beginning students.

The thesis concludes with suggestions for teaching procedures designed as an aid for reaching desired musical goals. Microfilm $2.00; Xerox $6.40. 135 pages.

CONCERTO-SINFONIA

(L. C. Card No. Mic 58-5853)

William Henry Rivard, Ph.D.
State University of Iowa, 1958

Chairman: Associate Professor Philip Bezanson

Concerto-Sinfonia is a three movement composition for small orchestra, in which certain features of both the symphonic and concerto orchestral styles are exploited. The instrumentation includes: one flute, one oboe, one B-flat clarinet, one bassoon, one F-horn, one C trumpet, one trombone, strings, timpani and snare drum. It is suggested that a string section of four first violins, four second violins, three violas, three violoncellos, and two contrabasses be utilized, but the composition may be played with a larger string section, providing problems of balance are taken into consideration. The duration of the work is approximately eighteen minutes.

Groups of like instruments, as well as individual instruments, are treated soloistically, and the entire ensemble is also used frequently in tutti with free combining of unlike instruments. The term sinfonia is used only in its literal meaning (i.e., symphony), and there are no direct formal relationships between this composition and earlier forms bearing the same name.

The tonal organization of the Concerto-Sinfonia is based on the use of highly dissonant harmonies which have some tonal foundations. There are definite tonal centers in each movement, but there has been no attempt by the composer to organize tonal materials in a traditional manner, but rather to try to incorporate subtly some feeling of tonality into a basically dissonant texture. Most of the standard twelve-tone techniques have been employed, and even though much of the melodic and harmonic material is based on tone-rows there is no "strict" or even fairly consistent twelve-tone writing. None of the movements follows conventional forms, but rather, they are based on formal principles which are manipulated to suit the nature of the musical material.

The first movement is constructed on a form based on the alternation of thematically unstable sections with sections of a more stable thematic organization, which results in a rondo-like form. The main key centers are C, F and G, and although never stable for any length of time, they provide points of departure or arrival for various sections of the movement.

The second movement utilizes a simple theme, decorated with dissonant counterpoint, which serves as the basis for several variations in arch-form. A recurring rhythmic pattern on four chords continues throughout the movement, which is in E.

The third movement is joined to the second by a sustained minor ninth between the horn and contrabasses and the two movements together are intended to offer a balance to the first. In the first few measures several musical ideas are exposed which form a basis for most of the rest of the movement. The form follows a basic ABCA organization, the C section being a chorale return of the theme of the second movement. Much of the individual instrumental writing is of a virtuoso nature, which is intended to point up the concerto aspects of the composition.

Microfilm $2.00; Xerox $5.60. 114 pages.

ANALYSES OF SEVEN MAJOR BAND COMPOSITIONS OF THE TWENTIETH CENTURY

(L. C. Card No. Mic 59-1119)

William Harmon Tarwater, Jr., Ph.D.
George Peabody College for Teachers, 1958

Major Professor: C. B. Hunt

The purpose of this study was to analyze seven of the most important original band compositions of the twentieth century. The selection of these works was restricted to published compositions in the larger forms (suites, symphonies, overtures, etc.) written expressly for the symphonic band medium by composers who are internationally recognized for their works for other media. A further restriction was based on significance to contemporary American musical life by virtue of widespread and repeated performance. After evaluation in terms of these objective criteria, the writer made the final selection on the basis of subjective evaluation of intrinsic musical value.

The seven compositions analyzed were: Symphony in B-flat by Paul Hindemith; Suite in E-flat by Gustav Holst; Music for a Festival by Gordon Jacob; Divertimento for Band by Vincent Persichetti; Psalm for Band by Persichetti; Symphony for Band by Persichetti; and Toccata Marziale by Ralph Vaughan Williams.

The analytic procedure and terms used followed traditional practices in musical analysis. Quotations from the scores were used to clarify and illustrate specific points.

In addition to the detailed musical analysis of each work, the following were included: a biographical sketch of the composer; circumstances of composition and first performance of the work; a listing of available recordings of the work; a listing of other original band compositions by the composer. The instrumentation and scoring of each work was examined, the major problems of rehearsal and performance were discussed, and the characteristics of style were summarized.

Microfilm $3.25; Xerox $11.20. 252 pages.

THE FANCIES OF ALFONSO FERRABOSCO II. (VOLUME I AND VOLUME II).

(L. C. Card No. Mic 59-1458)

Raymond Vaught, Ph.D.
Stanford University, 1959

The fancies of Alfonso Ferrabosco II occupy a central position in his total musical output. They far outnumber his other compositions, but because they have remained unpublished it has been difficult to define Ferrabosco's position in English musical history. The problem of defining his place more accurately has been threefold. First, it was necessary to prepare a reliable edition of his unpublished fancies based on the available manuscript sources. These, twenty-five in number, are presented in volume II, while the critical apparatus by which they were assembled occupies the appendices of volume I. Secondly, it was necessary to establish a background for the treatment of instrumental music in sixteenth and seventeenth century England, as well as for Ferrabosco's own life.

To this end, the importance of instrumental ensemble music in Renaissance England has been investigated. Furthermore, the musicians themselves, the music they played, and the instruments on which they performed are described. The background of the English fancy, including its continental and English forerunners, is traced up to 1628—the death date of Alfonso. Although little is known of his life, the essential facts of his biography have been assembled, and his musical output examined.

The third facet of the problem required a stylistic analysis of the fancies, particularly in regard to their relationship with the writings of contemporary English theorists. The works of Thomas Morley, John Coperario, and Charles Butler were used as a basis for this analysis. An examination of the melodic material of the fancies was undertaken first, followed by a consideration of the vertical sonorities. One of the most important ideas stressed by the theorists was that of the relation between rhythm and dissonance—a concept which opened a productive field of inquiry. In the field of imitation it was found that Alfonso's treatment falls into distinct patterns. This is particularly true in regard to the layout of fugal expositions, as well as the use of pedal and stretto to achieve drive and intensity at the conclusion of fancies. Finally, the form of the fancies provided interesting examples of Alfonso's predilection for well-defined, balanced, and unified structure.

The examination of these aspects of Ferrabosco's music reveals him as a composer essentially conservative in technique, yet thoroughly English in his liking for clashing sonorities. He occupies a particularly important place in the evolution of instrumental ensemble music in imitative style, for in this music the gentle flow of an even contrapuntal texture is separated into distinct units and is given a sense of direction which achieves a fine climactic drive.

Lastly, the presentation of the complete body of Ferrabosco's unpublished fancies enables us to appreciate more fully the importance of his contribution to the literature of early chamber music.

Microfilm $6.35; Xerox $22.00. 497 pages.

EXOTICISM IN DRAMATIC MUSIC, 1600-1800

(L. C. Card No. Mic 58-7938)

Miriam Karpilow Whaples, Ph.D.
Indiana University, 1958

It has long been assumed, without systematic proof, that in opera and ballet written before 1800 exotic (i.e. non-European) characters and locale are not reflected in the music. Since exoticism, stimulated by voyages of discovery and travellers' reports, is an important feature of the literature (including librettos) of the period 1600-1800, this assumption would seem to require more detailed proof than it has hitherto had. The purpose of this dissertation, therefore, is to examine for the first time the body of operas and ballets on exotic subjects and to determine to what extent, if any, this subject matter influenced the music.

Operatic dictionaries list about four hundred titles which suggest exotic subject matter; of these works about one hundred were available in full score or piano reduction. They were examined for exotic musical content, the following two criteria being observed:

(1) Music based on or quoted from published descriptions and transcriptions of non-European music in travel accounts. (The Appendix to the dissertation is an anthology of such descriptions and transcriptions from about fifty writers, collected here as some of the earliest documents of ethnomusicology.)

(2) Any significant departure (in an exotic context) from a composer's normal style. (Musical pseudo-exoticism.)

Practically no evidence of (1) was found. Specifically, the author discovered no musical quotations from the transcriptions of the travel writers, and no pentatonic composition for representations of Chinese or other Far Eastern peoples. However, on the basis of a modern reconstruction of the extinct Janissary music, we have tentatively concluded that the "Turkish" style of Mozart, Gluck, and others had some stylistic (and not only instrumental) basis in genuine Turkish military music.

Examples of (2) are frequent. They include the stylized exotic dances of the Baroque, isolated instances of musical primitivism (Graun, Dalayrac, R. Kreutzer, Spontini) and pseudo-Oriental chromaticism (Rameau, Gretry), and a few miscellaneous eccentricities some of which can be traced through the work of several composers without however, constituting a full-fledged style. Chief among these latter are the pseudo-Turkish idiosyncracies of Lully (Le bourgeois gentilhomme) and Campra (L'Europe galante). The ceremonial march for exotit rituals, which we trace from Lully's Bourgeois gentilhomme to Mozart's Zauberflöte, displays certain unifying melodic and harmonic traits, but these owe nothing to any non-European source. Of all the exotic and pseudo-exotic musical devices noted in the hundred scores, not one fell altogether outside the European vocabulary. For instance, no imitation of Oriental rhythmic organization (e.g. Turkish usul or Indian tala) was found, nor were there any indications of indeterminate pitches as occur in much Oriental and primitive music.

We conclude that the assumption stated in the first paragraph, while it fails to take into account the many individual essays in musical pseudo-exoticism, is largely accurate in so far as the absence of genuine "local color" in Baroque and Classical music is concerned. Some speculative explanations for this absence are: a) European contempt for monophonic music; b) the alienating effect of genuine exotic music which would negate the spirit of many librettos which express the essential brotherhood of mankind; and c) the self-sufficiency of Baroque and Classical musical styles. Microfilm $5.40; Xerox $19.00. 422 pages.

PHARMACOLOGY

CHELATION OF TRACE METALS BY DISODIUM CALCIUM ETHYLENEDIAMINETETRAACETATE

(L. C. Card No. Mic 59-1463)

Robert Vernon Blanke, Ph.D.
University of Illinois,
Chicago Professional Colleges, 1958

The treatment of lead poisoning has been far from satisfactory until the advent of chelating agents. These agents form stable, chelate structures with lead allowing the metal to be excreted without exerting a harmful effect. Calcium disodium ethylenediaminetetraacetate has been the most successful chelating agent used in the treatment of plumbism. The possible effect of calcium disodium ethylenediaminetetraacetate on biologically important trace metals prompted this investigation.

A method of separating small amounts of metals by paper chromatography prior to analysis is described. This is an extremely useful technique and deserves further study.

A method of simultaneously determining copper, lead, zinc and cobalt in biological material by polarographic analysis, and a separate, colorimetric method for zinc and lead are described.

Normal rabbits treated with 100 mgm/kg Na_2CaEDTA intraperitoneally for two weeks showed a general increase in iron, copper, zinc, cobalt and lead in the liver, spleen, kidney, and bone marrow. In the pancreas these metals tended to descrease.

Rabbits poisoned with lead by subcutaneous injection of lead acetate, failed to show increased amounts of lead in the tissues after four weeks. The irritant effect of lead acetate produced necrotic areas in the cutaneous and subcutaneous tissues. When these animals were treated with Na_2CaEDTA, 100 mgm/kg intraperitoneally for two weeks, there was a general decrease in iron, copper, lead, zinc and cobalt in the liver, kidney and spleen. The pancreas showed an increase in iron and copper and the bone marrow showed an increase in lead.

Due to lack of data on blood metal levels, as well as poor recoveries of copper and lead by the method used, the significance of these findings is difficult to evaluate.

Other groups of normal rabbits treated with 10 mgm/kg, 100 mgm/kg and 740 mgm/kg of Na_2CaEDTA intravenously for two weeks, when compared to controls, showed a decrease in blood zinc. However, zinc increased in bone, liver, kidney and spleen at all dose levels except with the highest dose at which zinc decreased in spleen and liver. The loss of zinc in blood can be explained by chelation followed by excretion of ZnEDTA. The tissue changes cannot be explained until more knowledge of zinc metabolism is obtained.

Other rabbits were poisoned with lead by slow, intravenous injection of 20 mgm/kg of lead acetate. Actual lead poisoning was evidenced by elevated blood and tissue lead levels as well as coproporphyrinuria. Groups of these rabbits were treated with 10 mgm/kg, 100 mgm/kg and 570 mgm/kg of Na_2CaEDTA intravenously for two weeks. When compared to controls they showed a decrease in blood lead and an increase in blood zinc levels. Hemoglobin rose from a subnormal value in the poisoned but

untreated animals, to greater than normal in those animals receiving the low and intermediate doses of the drug. With the highest dose, hemoglobin fell below normal. Tissue lead levels were relatively unchanged except at the highest dose of the drug at which the lead in liver and spleen increased. Liver, kidney and spleen zinc levels were low in the poisoned, untreated rabbits and were relatively unchanged at all doses of the drug. The zinc in bone was high in poisoned, untreated rabbits and dropped to low values when the drug was given at intermediate and high doses.

It is concluded that lead interferes with normal zinc metabolism by displacing zinc from sites within the cell or interfering with the utilization of zinc. This was evidenced by high blood zinc levels and low levels of zinc in liver, kidney and spleen.

It was shown that in the treatment of lead poisoned rabbits with Na_2 CaEDTA, lead is preferentially chelated over zinc as evidenced by a fall in blood lead but no change and even an increase in blood zinc. However, Na_2 CaEDTA promotes the loss of zinc from bone.

It is proposed that further studies of this type may produce information as to the mode of action of toxic metals if part of the effect of these metals is a disturbance of essential, trace metal metabolism.

Microfilm $2.00; Xerox $6.60. 136 pages.

EFFECTS OF CARCINOSTATIC AGENTS ON AMINO ACID METABOLISM IN THE WALKER CARCINOSARCOMA

(L. C. Card No. Mic 59-1469)

William Leo Nyhan, Jr., Ph.D.
University of Illinois,
Chicago Professional Colleges, 1958

Metabolic patterns for L-glutamate-U-C^{14} have been studied in individual tissues in vivo in rats bearing the Walker 256 carcinosarcoma at time intervals of 30 seconds to 8 minutes. The specific activities of the protein of the kidney, spleen, liver, and pancreas were 1.3 to 3.2 times greater than that of the tumor. On the other hand, the distribution of isotope to these tissues was 3 to 5 times greater than to the tumor, and the specific activities of the glutamate pools were 1.4 to 4.6 times that found in the tumor. At 8 minutes 22 per cent of the isotope of gluamate utilized by the tumor had been incorporated into protein. Similar values were noted in the liver and spleen, while the values for kidney and pancreas were 8 per cent and 33 per cent respectively. In the tumor, isotope was found in lactate at all time periods studied and amounted during the 3 to 8 minute interval to 25 per cent of the isotope of glutamate that was utilized. At early time periods significant quantities of the isotope of glutamate were not found in lactate in nontumor tissues. Isotope in protein, $C^{14} O_2$, glutamine, succinate, and aspartate made up the rest of the metabolic pattern in the tumor. In the liver, succinate was labeled early and contained at one minute 48 per cent of the non-glutamate isotope, while at 8 minutes most of the isotope was found in glutamine and protein. In the kidney, isotope in succinate was maximal at 3 minutes. At 8 minutes 68 per cent of the non-glutamate isotope was recovered in pyrrolidone carboxylic acid. The metabolic pattern for the spleen differed from that of other tissues in the absence of isotope in succinate. In the pancreas, a larger proportion of the isotope of glutamate was found in protein than in any of the other tissues studied. In the brain, muscle, testis, and heart, five per cent or less of the isotope of glutamate was found in protein. In the presence of malonate a decrease in the transfer of isotope of glutamate to lactate and $C^{14} O_2$ in the tumor was balanced by accumulation of isotope in succinate and glutamine. These studies indicate that glutamate is actively utilized by the Walker 256 carcinosarcoma in vivo. The efficiency of utilization for incorporation into protein was equal to or greater than that of all of the nontumor tissues studied except the pancreas. These data and the findings of previous experiments from this laboratory that tumors in vivo fail to utilize acetate and convert pyruvate primarily to lactate suggest that tumors in vivo utilize a segment of the citric acid cycle.

In order to assess the pathways of metabolism leading from succinate and to provide confirmation for the use of a segment of the citric acid cycle by tumors in vivo, studies were carried out using succinate-2-C^{14}. Metabolic patterns were determined in individual tissues of rats bearing the Walker 256 carcinosarcoma at intervals of 40 seconds to 8 minutes after the intravenous injection of the tracer. The total concentration of isotope in the kidney was 12 times that of the tumor, while that of the liver was 3 times that of the tumor. The isotope concentrations of pancreas, lung, muscle, and brain approximated that of the tumor and those of the spleen and testis were less. In the tumor, isotope was found in lactate at all time periods studied and amounted, over the 3 to 8 minute interval, to 51 per cent of the isotope of succinate that was utilized. Isotope in glutamate, aspartate, and malate made up the rest of the metabolic pattern. Labeling of protein from succinate was negligible in the tumor. In the liver, the major metabolic conversion of succinate was to glucose, which contained 30 per cent of the total isotope recovered over the 3 to 8 minute interval. In the kidney, the uptake of succinate, its utilization, and the movement of labeled compounds from the tissue were more rapid than in any of the other tissues studied. Most of the isotope found in the kidney was transferred to the amino acids, glutamate, and aspartate, which contained 34 per cent of the total isotope present as early as 40 seconds. The kidney was the only tissue which incorporated significant quantities of the isotope of succinate to protein. In testis and brain, the percentage of total isotope in lactate approximated that of the tumor at 8 minutes, but the concentrations of labeled lactate in these tissues at early time intervals were one-fourth to one-sixth that found in the tumor. In the presence of malonate the transfer of the isotope of succinate to lactate was effectively blocked in the tumor, while in the liver the percentage of total isotope recovered in succinate was unchanged by malonate. These studies indicate that succinate is actively utilized by the Walker tumor in vivo. Evidence is provided for a partial utilization of the citric acid cycle in the tumor, which could function as a source of energy and hydrogen acceptor.

The active utilization of glutamate by tumors in vivo and the previous findings from this laboratory that these tumors are capable of incorporating the isotope of previously-labeled plasma proteins into cytoplasmic particulates suggested the investigation of analogues of amino acids, peptides, and proteins in the search for cytotoxic

agents that might have greater specificity than those currently available. An attempt was made to synthesize the nitrogen mustard analogue of glutamic acid, with the aim of utilizing the amino acid moiety as a biological carrier for the cytotoxic group. The structure of the product obtained in a conventional synthesis has not been established. However, the intravenous administration of a single dose of the product, amounting to one-fourth to one-eighth of the LD_{50}, resulted in suppression of the growth of the Walker tumor. These results were superior to those observed with one-half an LD_{50} dose of HN2. The incorporation of amino acids into the proteins of cellular fractions of tissues in vivo was studied in rats whose tumors had been rendered non-growing by the administration of the product. Inhibition of the incorporation of labeled glutamate or lysine was observed only in the tumor. In the tumors of treated animals, the incorporation of L-glutamate-U-C^{14} into proteins of the cytoplasmic sap and of the nucleus was inhibited to a level of 35-50 per cent of the values observed in controls, while the overall specific activity of the protein of the tumors of treated animals was 40 per cent of that of controls. The greatest degree of inhibition noted was in the HCl-insoluble fraction of the protein of the tumor nucleus. The incorporation of L-lysine-U-C^{14} was significantly suppressed in only one fraction, the HCl-insoluble protein of the tumor nucleus. These experiments indicate that the product obtained in the attempted synthesis of the nitrogen mustard of glutamic acid acts in the tumor as a glutamic acid analogue. They suggest that the HCl-insoluble nuclear protein is of major importance in the growth process.

Microfilm $2.85; Xerox $9.80. 219 pages.

PHILOSOPHY

"SENSE-DATUM," SENSE-DATA, AND PHENOMENALISM

(L. C. Card No. Mic 58-7847)

Clyde Laurnce Hardin, Ph.D.
Princeton University, 1958

Supervisor: Carl G. Hempel

Sense-datum analyses are of two main types: those which involve an appeal to kinds of entities known as sense-data, and those which are concerned to show how an expression such as "sense-datum" may be of use in the discussion of the problems of perception. These two approaches, which have in the past been confused with one another, may be regarded as alternative ways of justifying the inference from "appearing" statements to "sense-datum" statements. Discussion of the first way (the "ontological thesis") involves us in certain paradoxes concerning sense-data and raises the question of the superiority of the rival "theory of appearing," which proves to be no more successful in resolving the equivalent puzzles. Although the ontological thesis has certain merits, it falls short of its goal as a justification of the inference. The same may be said about the "linguistic thesis," the discussion of which leads to a consideration of the adequacy of ordinary language for the discussion of problems of perception. A third way of validating the inference involves an examination of the claims that statements of "immediate perception" are incorrigible and serve to express the evidential foundation of empirical knowledge. Both contentions are rejected.

Many of the difficulties inherent in these three approaches are found to be resolved when sense-data are treated as states of an observer and incorporated into a theoretical model of sense-perception. This does not, however, say all one wants to say about the private or "autistic" use of sensationalistic expressions. This leads to a discussion of private language, the possibility of which has been denied by Wittgenstein. It is argued that the latter fails to prove his point.

Phenomenalistic theories of material objects may also be divided into linguistic and ontological types. Both varieties have been vigorously attacked, but many of the stock arguments against one or the other form of phenomenalism are shown to be less effective than they are often believed to be. However, certain arguments do succeed in defeating linguistic phenomenalism, and ontological phenomenalism can withstand attacks only by retreating to a solipsistic position. Solipsism, again, proves to be more hardy than commonly thought, though it can only be maintained by a postulate which narrowly restricts the admissibility of evidence. It is suggested that if rules could be stated in a sensationalistic metalanguage for manipulating primitive material-object expressions in an object-language, a system could be constructed which might satisfy the scruples of phenomenalists without being subject to any of the difficulties inherent in a metaphysical or a translationalistic program.

Microfilm $2.85; Xerox $9.80. 217 pages.

A CONCEPT OF SELF AND VALUE FROM WHITEHEAD AND ITS IMPLICATIONS FOR EDUCATION

(L. C. Card No. Mic 59-459)

James Augustus Jordan, Jr., Ph.D.
Emory University, 1958

Supervisor: John B. Cobb Jr.

Creativity, many, one (principles taken from Whitehead's metaphysical position) and beauty and truth (concepts taken from Whitehead's theory of value) serve as the starting point from which, through a process of analysis and expansion, a concept of self and value is developed.

The analysis and expansion of creativity, many, and one yield a self with a special and private inheritance, a general inheritance interconnected with and related to all the entities in the immediately past universe, and a

creativity which makes the self ultimately responsible for what it becomes. When these notions about the metaphysical character of the self are related to Whitehead's concepts of beauty and truth, the value possibilities open to the self are (1) the increase of the experience of beauty within that aspect of itself which remains private and special, (2) the adjustment of the experiences open to the self in such a way as to promote an increase in the experience of beauty among entities external to the private self. Pursuit of these value possibilities is discussed in terms of developing an aesthetic and an ethical self. Mediating between these two value possibilities, what is called the moral self furnishes the impetus or "ought" which guides the self in its value choices.

A brief analysis of Dewey's concepts of growth and interest serves as an introduction to the implications which the developed concept of self and value has for education. If selves are ultimately responsible for what they become, then education must construct a program which places the ultimate responsibility for education upon the individual. If selves are unique and private, then there is neither the possibility of giving each individual the same education nor the possibility of educating individuals at the same rate. If there are but two paths to value and the greatest value is attained through the development of ethical selves, then the function of the school is to construct a program which encourages the development of individuals who feel the full press of the moral toward the ethical. In other words, education must be for the purpose of providing fully developed moral selves.

Microfilm $2.80; Xerox $10.00. 223 pages.

STUDIES IN TWENTIETH CENTURY SPANISH PHILOSOPHY

(L. C. Card No. Mic 59-1277)

Rigoberto Juarez-Paz, Ph.D.
University of Minnesota, 1958

The introductory chapter has been designed to give a general view of the cultural and political history of nineteenth century Spain, thus hoping to account for (a) the scarcity of philosophical thought at this time; (b) Balmes' failure to influence the course of philosophical studies in Spain; (c) Sanz del Rio's success in arousing interest in German philosophy and in introducing the philosophy of Krause; (d) the poverty of the teaching of philosophy at Spanish Universities; and (e) the lack of continuity between nineteenth and twentieth century philosophical thought in Spain. It is pointed out that neither Unamuno nor Ortega, the two leading Spanish philosophical thinkers of the recent past, could find anything useful in the philosophical thought of the nineteenth century.

The central themes of Unamuno's philosophy are then introduced. Special attention is paid to the central position occupied in his thought by the question of immortality, but even more importantly, to the guiding role played in his philosophy by his conception of the world as a collection of striving, purposive agents or substances, in which conception the imagination is assigned the substantivating function.

An attempt is made to contrast Unamuno's phenomenalism, the view of the world which, according to him, reason forces upon us, with his substantialism, the view of the world our will demands. It is remarked that although Unamuno seems to have been concerned with describing the nature of the world of science and common sense, he was actually more interested in discussing the framework of human action, the world of the man of will. This accounts, on the one hand, for his agreement with Hume and his generally phenomenalistic outlook, and on the other, for his insistence on the substantiality of other people and the reality of God and immortality. Unamuno adopts phenomenalism in order to assert, not to deny, the existence of things in themselves.

The discussion of Ortega's metaphysics of vital reason is then taken up. The clarification of the concept of vital reason reveals that it essentially involves (a) the abandonment of the hypothesis of the noumenal self; and (b) the recognition of the mobility of reason, i. e. the denial of the existence of a fixed set of a priori concepts.

After presenting a sketch of Dilthey's philosophy, Ortega's claim to the effect that his philosophy constitutes an improvement upon Dilthey's is examined in detail. It is concluded, among other things, that Ortega's claim is unwarranted. It is then suggested that if the idea of vital reason is construed as a super metaphysics, as some students of his thought have construed it, this is due to a misunderstanding of what the idea of vital reason actually is.

The thesis concludes with the suggestion that the Spanish philosophy of the future will be written by Spaniards and Latin Americans trained in England and the United States. Microfilm $3.30; Xerox $11.20. 255 pages.

ALEJANDRO KORN'S INTERPRETATION OF CREATIVE FREEDOM

(L. C. Card No. Mic 59-168)

William Jackson Kilgore, Ph.D.
The University of Texas, 1958

Supervisor: David L. Miller

In the development of his own philosophical position Korn drew from a number of European sources such as Kant, Schopenhauer, Bergson, Dilthey, and some writers in historical materialism. He formulated his view of creative freedom in opposition to the Argentine versions of deterministic positivism.

All knowledge according to Korn is limited to consciousness. Awareness of the subjective pole of consciousness is made possible by the opposition to it of the objective pole. The dualism between the subjective order and the objective order of consciousness is made in the knowing process, but any attempt to make of this epistemologically created dualism a metaphysical dualism is unwarranted. Metaphysics is to be classified as poetry rather than as philosophy. Science which is concerned with the measurable has as its field the objective order of consciousness. Philosophy which is concerned with evaluations has as its field the subjective order of consciousness. The objective order is determined. The subjective order has the polarities of coercion and freedom. Freedom is an achievement in the subjective order. Economic freedom is

the achievement of greater control over the forces of the objective order. Ethical freedom is the realization of personal autonomy over the coercive features of the subjective order. Creative freedom makes possible man's construction of his culture. It is through creative action in the social, economic, educational and political world that man solves in a practical way the problems which were raised in a theoretical way by his intelligence but which his intelligence apart from action was unable to solve in a satisfactory manner. Man is an animal who wills to live freely.

Korn's presentation of freedom is partly dependent upon insights which he derives from Kant and Bergson. He agrees with Kant that freedom of the will is a necessary condition for moral behavior, but he criticizes Kant for placing freedom in the noumental world and for postulating the immortality of the soul and the existence of God. Korn agrees with Bergson in making time or duration applicable only to the subjective order. Korn rejects Bergson's interpretation of intuition and is critical of the metaphysical and mystic tendencies which are found in Bergson's philosophy.

Korn does not account adequately for the initial givenness of consciousness. He does not provide for a knowledge of other minds or of an external world other than as passing states in the flux of consciousness. There are tendencies in his thought toward epistemological solipsism.

While Korn claims to be a relativistic in his theory of value, his emphasis upon the achievement of the greatest creative freedom on the part of an autonomous personality indicates that he is less relativistic in his theory of value than he proposes to be. He insists upon the need of a constant re-evaluation and reinterpretation of any proposed value structure. While Korn justifies theoretically a type of freedom in which there is a kind of spontaneous activity of working toward goals in the subjective order of consciousness, the freedom which he discusses practically is a freedom of creative action in the world of personal and social relations and in the control over the forces of nature. He fails to give adequate analysis to many of the traditional problems about the nature of freedom. The fact that man is free or can achieve freedom is known directly in consciousness through the resistance that is offered to his will and through his awareness of control or domination over some of these resisting forces.

Korn contributed to the creation of a theoretical interest in philosophy in Argentina. He was an active participant in the university reform movement. His work on the history of philosophical ideas in Argentina is outstanding. His followers have continued to emphasize his idea of creative freedom, but they have not followed the particular philosophical structure which he gave to it.

Microfilm $3.15; Xerox $10.80. 242 pages.

VOLTAIRE'S CONSTRUCTIVE DEISM

(L. C. Card No. Mic 59-906)

Rosemary Zita Lauer, Ph.D.
St. Louis University, 1958

Voltaire's acquaintance with the theories of Isaac Newton on the physical universe, of Anthony Collins on human freedom, and of John Locke on man's understanding led the philosophe to attempt a rational explanation of the relationship existing between God and the world of nature, an explanation which would depend solely upon sense experience and reason and not at all upon any theological dogma. The results of this attempt are such that they can justly be called a system of constructive deism.

As Voltaire views the material universe, it is made up of inert matter, which exists eternally and independently of God, who has from eternity imposed upon matter the various forms it displays today and has always displayed. Man, too, is composed of divinely formed matter, but he differs from the rest of creation by having received from God the powers of sensation and thought, powers the other animals also have, but to a lesser degree.

All that occurs in the material universe, including man's acts of willing and the formation of society with its laws, rewards and punishments, is a consequence of the divine causality. God, whose existence is known principally from the order found in the universe, operates on matter according to eternal, unchangeable, mathematical laws. God does not foresee all the consequences of these laws, nor could he, even if such foreknowledge were possible, operate in any manner other than that according to which he has eternally acted.

Moral good and evil, which always involve the relationship of one man to another, are without meaning when predicated of God. God is the unique geometer, eternally forming and moving matter in order to produce the best possible universe. That is, while, from the human point of view, the universe is imperfect in many respects, it is the best universe that God, who operates necessarily and according to his nature, could have produced. Nor can man, who is only a puppet moved about by the creator, perform any independent action to improve upon the universe. Whatever occurs in the universe is a direct and necessary consequence of the divine nature.

Microfilm $3.70; Xerox $12.40. 285 pages.

A STUDY OF THE LITERARY BACKGROUND AND THE METHODOLOGY OF ST. THOMAS' COMMENTARY ON THE POSTERIOR ANALYTICS OF ARISTOTLE

(L. C. Card No. Mic 59-909)

Paul Luke Mathews, Ph.D.
St. Louis University, 1958

This dissertation represents the resolution of the problem of determining the conditions necessary for a historical doctrinal study of the Commentary on the Posterior Analytics, and of laying the basis for such a study. The historical conditions examined were the basic literary ones of the status of the Latin translation of Aristotle used by St. Thomas, and of the possible sources, especially other commentaries, which St. Thomas might have utilized in the elaboration of his own comment.

The main effort of the dissertation was made in the area of methodology. A special method was employed: separate "readings" were made for each discoverable facet of St. Thomas methodology. The Thomistic techniques of the division of the text, interpolated passages,

key doctrinal themes, use of examples, and use of citations were each discussed.

The greater number of the interpolated passages were found to be introduced by gerundive "signals," such as sciendum est and considerandum est. In a large number of cases it was possible to discover a relationship between a sciendum passage and a considerandum passage which followed it. In general, the texts introduced by sciendum were basically informative, usually providing principles. The considerandum passages were found in many instances to recall the principles of a sciendum passage, to use them for a new advance in knowledge.

Two major conclusions emerged from our study. The first concerns methodology, and is to the effect that for the Commentary on the Posterior Analytics, at least, St. Thomas is in possession of a number of techniques which are skillfully used in the exposition of doctrine. A knowledge of these techniques adds an entirely new dimension to the comprehension of St. Thomas' Commentary on the Posterior Analytics.

In every instance of our examination of the techniques employed by St. Thomas, there was evidence that they displayed, besides their methodological character, a pedagogical aspect. This leads us to our second conclusion, that the various techniques have a supplementary pedagogical orientation.

We may say that St. Thomas wrote his Commentary as if it were to be taught, whether or not St. Thomas actually did so.

Finally, our study suggests that its conclusions and methods might be profitably extended and tested by future research in other works of St. Thomas.

Microfilm $4.85; Xerox $16.20. 3.80 pages.

PHYSICS

PHYSICS, GENERAL

I. CONSTRUCTION AND OPERATION OF A DIFFUSION CLOUD CHAMBER. II. BREMSSTRAHLUNG YIELD OF HIGH-ENERGY ELECTRONS IN HYDROGEN.

(L. C. Card No. Mic 59-1434)

David Moses Bernstein, Ph.D.
Stanford University, 1959

Supervisor: W. K. H. Panofsky

Part I of this thesis is a description of a diffusion cloud chamber and of associated equipment used in a positron-electron scattering experiment. The sensitive region of the cloud chamber was 16 x 22 in. and about 2-in. deep. Methyl alcohol was used as a vapor and nitrogen as a gas. A positron beam about 10-in. wide, 1/4-in. high, and composed of about 100 positrons per accelerator pulse, passed through a 1/2-in. beryllium target and then into the sensitive volume of the cloud chamber. The chamber was photographed and the pictures were scanned for recoil electrons from positron-electron scatterings. The results of this experiment will be reported elsewhere.

Part II pertains to the experimental measurement of the bremsstrahlung yield of high-energy electrons in hydrogen. The yield of 235-Mev photons produced by 500- and 550-Mev electrons was measured in a liquid-hydrogen target. The photons were traced via the production of positive photopions. The result demonstrates a cross section $(2.4 \pm 2.8)\%$ below the calculations of Wheeler and Lamb. The result can be accounted for by (a) the exchange effect between the final electrons, and (b) interference effects among the protons and electrons in molecular hydrogen. A calculation on (b) was carried out using Heitler-London wave functions. Microfilm $2.00; Xerox $3.60. 63 pages.

MASSIVE CONDENSATIONS IN INTERSTELLAR MATTER AND STELLAR ASSOCIATIONS

(L. C. Card No. Mic 59-1189)

Joseph Francis Bird, Ph.D.
Cornell University, 1958

The expanding associations of young stars, particularly the striking phenomena seen in Orion--viz., a few very high velocity stars originating from the center of an expanding hydrogen cloud of $\sim 10^5$ solar masses--has led to the speculation of T. Gold et al. that a nuclear explosion may occur in a massive condensation of interstellar gas when it has contracted to stellar densities. We have investigated this possibility by following the history of such an object, beginning from its formation in the interstellar medium.

Since out work is essentially an exploratory attack on the problem, we have sought mainly to obtain a qualitative idea of the processes involved. However, we have considered all the important factors, namely, self-gravitation, thermal (gas and radiation) pressure, turbulence, magnetic fields, and rotation. We base our analysis on a virial theorem which includes all these effects, thus avoiding, for the most part, questions of the distribution of density, temperature, etc., within the condensation. The calculation was done for the cases (a) negligible rotation at all densities, (b) non-negligible rotation.

In both cases we find that before a large cloud complex is able to contract appreciably, a "core" condenses under self-gravitation. Thereafter, we find that the thermal pressure remains small compared to the gravitational pressure until stellar densities are reached--provided only that the core mass (M_c) is $\gtrsim$ 10 solar masses. Since turbulence is never very supersonic, and in case (b) is in fact subsonic, the turbulent pressure is also small. Magnetic dynamic effects we show to be negligible--except for qualitatively

unimportant effects at the time of core formation. In case (a) then we have free-fall until stellar densities are reached. In case (b), however, we estimate the rotational energy becomes comparable with the gravitational energy early in the contraction. Thereafter the contraction is secular, with rate fixed by the angular momentum ($\mathcal{J}$) loss rate. We find this loss occurs via turbulent diffusion from the interior of the core, while at the surface mass transport takes over. That is, the core contracts by leaving behind shells which carry the excess $\mathcal{J}$. Magnetic transport we find negligible (except perhaps at the time of core formation).

In case (a), stellar densities are reached with $M_c \sim 10^2$ to 10^4 solar. We find that, if $M_c \lesssim 100$, the contraction halts before nuclear reaction rates are large, and the result is an ordinary star. For larger masses, contraction does not halt before nuclear energy is released in amount generally sufficient to explode the core.

In case (b), when stellar densities are attained, $M_c \sim 10$ to 10^4 solar, and the core is surrounded by a "jelly" ~ 10 to 100 times more massive and of (roughly) interstellar density. We find that for $M_c \lesssim 10$ to 100, thermal pressure halts the contraction before nuclear reaction rates are large and there results an ordinary star. For larger mass, the "main sequence" equilibrium position is "overshot," and the contraction does not halt until nuclear energy production becomes comparable with rotational energy loss via $\mathcal{J}$ transport. Then a slow expansion back to the main sequence ensues. During this reexpansion undamped pulsations occur which may grow to explosive proportions.

In both cases, the luminosity of the core is large in the last stages of contraction--in case (b) the surface temperature and specific luminosity become those of an O-star.

We conclude that in the unrealistic case (a) an explosion is highly likely, while in case (b) it is possible. In both cases the main reason for the explosive end lies in the large mass of the core. We point out that the high core luminosity may fill the role of that of a newborn O-star assumed in certain theories of stellar associations.

Microfilm $3.90; Xerox $13.20. 303 pages.

SOUND PROPAGATION IN SHALLOW LAYERS

(L. C. Card No. Mic 58-7640)

Ronald Kraft Eby, Ph.D.
Brown University, 1958

Pekeris[2] has given a theoretical solution to the simplest case of sound propagation in layered media. This is the case of an acoustic point source in one non-absorbing fluid which forms a layer of finite depth over a second non-absorbing fluid which is semi-infinite in extent. The essence of his solution is the existence of "normal modes" which are unattenuated save for geometrical spreading as they travel radially away from the source. These unattenuated modes can be analyzed into two sets of plane waves traveling in a zigzag fasion with perfect reflections alternately at the top and bottom surfaces of the upper layer.

The impedance mismatch at the top and the complete internal reflection of the plane waves at the bottom are the reasons for the perfect reflections and for the undissipated propagation of the modes. If the reflection at the bottom is not complete, the modes will be attenuated.

Three effects which will spoil the complete internal reflection are: (a) a bottom material which absorbs sound; (b) a bottom material which supports shear waves - a case not fully studied here; and (c) a rough interface, which scatters sound, between the two layers. Kornhauser and Raney present a theoretical explanation of the first, but not much theoretical work has been published on the last.

In this thesis an acoustic model has been used to study the various aspects of sound propagation in layered media. It consists of a water layer overlying a sound absorbing synthetic rubber bottom which has a density and sound velocity greater than that of water. The water layer was made effectively infinite in horizontal extent by edging it with a non-reflecting sound absorbing material. A small source and microphone were placed in the water layer in order to observe radial and vertical pressure distributions. Results are presented which verify the Kornhauser-Raney theory. A semi-empirical analysis and explanation are presented for the effects of roughening (by adding a scattering of metal shot) the interface between the two media. The attenuation, which is caused by the shot, is found to depend on the radial intensity of the normal mode at the depth of the shot, the scattering cross section, and the area density of the shot. It is also dependent on another function which determines how much of the scattered energy is actually lost.

The predictions made by Williams and Lewis[10] about the effects on the Pekeris solution of sloping the interface are also verified.

Microfilm $2.00; Xerox $3.80. 70 pages.

ABSOLUTE INTENSITY MEASUREMENTS OF SMALL ANGLE X-RAY SCATTERING

(L. C. Card No. Mic 59-1170)

Louis Katz, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor W. W. Beeman

A technique for making absolute measurements of small angle x-ray scattering was developed to be a convenient supplement to studies on macromolecules and on the defect structure of solids. Several important effects of the geometry of the slit-collimating apparatus are discussed, and the data are corrected for these. The measurement of the thickness of the sample is described, and the transmission measurements used are discussed.

The theoretical comparison between the standard scatterer, air, and the heavy gas, SF_6, was verified experimentally. The 5% agreement also established a probable error in the use of the standard arbitrary scatterer, a lucite sheet, for comparisons of intensities from day to day.

The experimental scattering from sucrose solutions was measured and agreement within 12% of theory was obtained.

Studies of water, alcohol and benzene gave scattering 27%, 32% and 18% in excess of the simply predicted values respectively. This excess is ascribed to angular dependent molecular correlations in the liquids.

Crystal quartz, fused silica, annealed copper and annealed nickel were studied as a function of temperature.

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The scattering from the quartz was 0.6 the predicted value. The explanation for this is not understood. The scattering from fused silica was that which is predicted on the basis of an internal structure characteristic of the annealing temperature.

The scattering from the metals contains two components. The first is angularly independent and shows a temperature behavior characteristic of the phonon scattering from the foil. The second component, which appeared as a small-angle rise in intensity, is due to the impurities and defect structure in the foils.

Sources of error are discussed and the precision of these absolute measurements is estimated to be $\pm$ 10%.

Microfilm $2.00; Xerox $5.40. 107 pages.

QUASI-RESONANCE AND CLASSICAL APPROXIMATIONS IN THE THEORY OF COLLISION BROADENING

(L. C. Card No. Mic 59-904)

Lee J. Kieffer, Ph.D.
St. Louis University, 1958

Because of the difficulty of applying the P. W. Anderson theory of pressure broadening, simplifications have been proposed.[1] In an article by Perkins, Bushkovitch and Kieffer[2] a simplified theory is outlined and applied to three cases of foreign gas pressure broadening of linear molecules. The theoretical collision diameters calculated using this simplified Anderson theory were in reasonable agreement with the experimentally determined diameters.

This investigation has shown the relationship between this simplified theory and the exact Anderson theory and given some quantitative estimate of the applicability of these simplifications to various types of van der Waals forces between linear molecules.

The crucial differences between the Anderson theory and the simplified theory as outlined in the article by Perkins et al are:

1. The perturbing molecule is treated classically. A classical rather than quantum-mechanical average is substituted for the possible orientations of the perturbing molecule.
2. The matrix $P_{\alpha\beta}$ is calculated by setting $w_{\alpha\beta} = 0$ and thus dropping the exponential term from the time integral for $P_{\alpha\beta}$ which is

$$P_{\alpha\beta} = \frac{1}{\hbar} \int_{-\infty}^{\infty} \exp(i w_{\alpha\beta} t)\ (\alpha|H(t)|\beta)\ dt$$

where H(t) is the intermolecular potential as a function of time and α and β represent all the quantum numbers necessary to describe the initial and final states of the system due to the collision.

$$w_{\alpha\beta} = \frac{E\alpha - E\beta}{h}$$

The following general conclusions were arrived at concerning the simplified theory as outlined in the article by Perkins et al as compared to the exact Anderson theory for the case of linear molecules.

It was found that the simplified theory was equivalent to assuming that ALL PARTIAL CROSS SECTIONS ARE QUASI-RESONANT (OF THE SAME ORDER OF MAGNITUDE AS THE RESONANT PARTIAL CROSS SECTIONS) AND ALL PARTIAL CROSS SECTIONS ARE EQUAL TO THE QUASI-RESONANT PARTIAL CROSS SECTION FOR LARGE VALUES OF J_2.

The partial cross-sections for linear molecules are defined as

$$\sigma_{J_2} = \int_0^{\infty} 2\pi b\ S_2(b,J_2)db\ .$$

Quasi-resonant as applied to a cross-section means the assumption is made that $w_{\alpha\beta} = 0$. A resonant partial cross-section is one which allows the radiating and perturbing molecules to exchange a photon due to collision; $S_2(b,J_2)$ is the probability that a collision will interrupt the radiation and equals the sum of all off diagonal elements squared of $P_{\alpha\beta}$ averaged over the two possibilities that the radiating molecule is in the initial or final state of the radiative transition.

Using the simplified theory the following cross sections were calculated:

(1) Dipole-dipole

$$\sigma = 2\pi \frac{2}{3} \left[\frac{\mu_1\mu_2}{v\hbar}\right] [g(J_i) + g(J_f)]^{\frac{1}{2}}$$

where

$$g(J) = \frac{2J^2+3J+3}{2J^2+4J+3}$$

(2) Dipole-quadrupole

$$\sigma = \frac{3\pi}{2}\left[\frac{8}{45}\right]^{\frac{1}{3}}\left[\frac{\mu_1 Q_2}{v\hbar}\right]^{2/3}$$

(3) Quadrupole-quadrupole

$$\sigma = \frac{4\pi}{3}\ [.166]^{\frac{1}{4}}\left[\frac{Q_1 Q_2}{v\hbar}\right]^{\frac{1}{4}} X$$

$$[g'(J_i) + g'(J_f)]$$

where

$$g'(J) = \frac{J^2+J-1}{(2J+3)(2J-1)}$$

(4) Dipole-induced-dipole

$$\sigma = \frac{5\pi}{4}\left[\frac{63}{2560}\right]^{\frac{1}{5}}\left[\frac{\mu_1^2 a_2\ \pi}{v\hbar}\right]^{2/5} X$$

$$[g'(J_i) + g'(J_f)]^{1/5}$$

where a_2 is the polarizability of the perturber

(5) Dispersion

$$= \frac{5\pi}{4}\left[\frac{\pi}{16\ v\hbar}\ \frac{I_1 I_2}{I_1 + I_2}\right]^{2/5} X$$

$$[g'(J_i) + g'(J_f)]^{1/5} X$$

$$[\gamma_2^{\,2}(1.57) + \gamma_1\gamma_2(1.05) + \gamma_1^{\,2}(.62)]^{1/5}$$

where

$$\gamma_1 = (a_1'' - a_1')(a_2'' - a_2')$$

$$\gamma_2 = a_2'(a_1'' - a_1')$$

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a″ is the polarizability of a linear molecule parallel to the symmetry axis and a′ is the polarizability of a linear molecule perpendicular to the symmetry axis. I_1 and I_2 are the ionization energies of the radiator and perturber respectively.

It was found that the simplified theory did not give an adequate description of the cross-sections for the dipole-dipole interaction. The calculated collision diameters were in many cases factors of three larger than the measured values.

In the case of the dipole-quadrupole and quadrupole-quadrupole interactions the simplified theory leads to cross sections which differ from those of the exact theory by a maximum of 30 per cent for large values of J_2 under the restrictions listed in Table 1. v, the mean relative velocity of the radiator and perturber, was taken to be (5) 10^4 cm/sec.

TABLE 1

k	r_e in Å	Maximum Frequency in Megacycles
.50	50	8,300
.50	20	20,000
.50	10	40,000

$$k = \frac{w\alpha\beta^{b}}{v}$$

The cross-sections calculated for the dipole-induced-dipole and dispersion interactions for symmetric perturbers differed from these calculated using the exact Anderson theory by less than 10 per cent with $k \leq 1$ and $v = (5)\ 10^4$ cm/sec for frequencies of transition for the radiator as listed in Table 2.

TABLE 2

Collision Diameter in Angstrom Units	Maximum Frequency in Megacycles
50	16,000
20	40,000
10	80,000
5	160,000

These results show that the simplified theory has some reliability. The cross-sections for the cases of dispersion and dipole-induced-dipole interactions for symmetric perturbers are a good approximation to the exact Anderson theory. For the dipole-quadrupole and quadrupole-quadrupole interactions the simplified theory has limited validity but can be used to give estimates of quadrupole moments. The quasi-resonant assumption cannot be used for the dipole-dipole interaction.

Microfilm $2.00; Xerox $3.80. 68 pages.

1. W. V. Smith, and R. Howard, "Microwave Collision Diameters II Theory and Correlation with Molecular Quadrupole Moments," Phys. Rev. 79, 132 (1950).

2. K. L. Perkins, A. V. Bushkovitch, and L. J. Kieffer, J. Chem. Phys. 26, 779 (1957).

A METHOD FOR MEASURING MAGNETIC FIELDS IN SUPERCONDUCTORS

(L. C. Card No. Mic 59-538)

Harold Ralph Lewis, Jr., Ph.D.
University of Illinois, 1958

A method is described for measuring the penetration of magnetic fields into superconductors. The field, H(x), at a depth, x, from the surface is detected by observing the rotation of the directional correlation pattern of cascade gamma rays emitted from nuclei located at the depth x. The rotation of the correlation pattern is due to Larmor precession of the magnetic dipole moments of nuclei in the intermediate nuclear state. The number of radioactive atoms is less than the number in a monolayer and, therefore, a very thin field probe can be obtained at the depth x.

The method has been used in an attempt to measure H(x) in superconducting lead. A specimen is prepared by depositing radioactive In^{111} atoms on a lead film which is thick compared with the penetration depth. The surface is then covered with a second lead film whose thickness is x. The formation of the lead films and the deposition of the activity are accomplished by vacuum evaporation techniques.

The Meissner effect has been observed in lead. However, further investigation of the specimen preparation technique is necessary before a good measurement of H(x) is achieved. Microfilm $2.00; Xerox $4.20. 79 pages.

A STUDY OF PHTHALOCYANINE AND SOME OTHER PLANAR MOLECULES IN THE FIELD EMISSION MICROSCOPE

(L. C. Card No. Mic 59-768)

Allan Jack Melmed, Ph.D.
The Pennsylvania State University, 1958

After a brief historical sketch of the problem an improved technique for studying organic substances in the field emission microscope is described, in which the field emitter is kept at a low temperature during observations. The results of adsorbing several highly stable organic dyes (all having planar molecules) onto tungsten emitters at about -195°C are given. It is found that the adsorption properties of Cu-phthalocyanine at this temperature are considerably different than at room temperature, and it is shown that no prior tip contamination or buildup is necessary for the production of "molecule patterns." It is found that phthalocyanine quadruplets (fourfold symmetric patterns) exhibit excellent orientation to the tungsten surface, and that there is an apparent preference for adsorption on the [110] planes. This is discussed in terms of the finding that organic molecules can be adsorbed on some regions of the surface and not be visible. It is found that many molecule patterns, especially in the case of flavanthrene, disappear when the field is temporarily removed, and that many molecule patterns change in appearance as a continuous function of field strength.

Phthalocyanine patterns are found to behave quite differently than patterns due to Cu-phthalocyanine. Cu-phthalocyanine patterns, although exhibiting marked

differences in size and intensity, always disappear as single units under cathode sputtering or heating whereas under the same treatment phthalocyanine patterns disappear in several steps, e.g. discrete gradations in size and intensity. Quadruplets exhibit as many as 6 stages and doublets as many as 3 stages. It is shown, in another experiment, that there is no appreciable amount (if any) of molecular decomposition of Cu-phthalocyanine on clean tungsten.

The results of adsorbing organic substances on various clean metals are given and discussed. Cu-phthalocyanine was studied on clean W, Mo, Re, Ta, Ir, Pt, and V, and differences in the resulting molecule patterns were found. Flavanthrene patterns, however, appeared substantially the same on all substrate materials used (W, Pt, V).

The influence of the field strength on the degree of coverage of organic substances on tungsten is experimentally investigated. It is found that the degree of coverage increases with increasing magnitude of the field strength and also that molecule patterns can be produced without the influence of cathode sputtering.

An experiment was performed to determine whether molecule patterns are due to single molecules, fractions, or multiples of molecules. The results indicate that Cu-phthalocyanine patterns are due to several molecules on the average, and that flavanthrene patterns are due to one, two, or three molecules.

The desorption of Cu-phthalocyanine from tungsten and platinum was studied and the results indicated that hydrogen ion images of Cu-phthalocyanine should be feasible. Hydrogen ion images were obtained, but image quality was not very good.

Finally, the experimental results are discussed and a possible mechanism for image formation is proposed as follows: The adsorbed single molecule, or stack of molecules, acts as an aperture through which emission of electrons, originating in the metal, is easier than through the surrounding surface of the substrate. The electron beam passing through the molecule interacts with the excess negative charge distribution of the polarized molecule and is thereby split into two or four equally intense beams.

Microfilm $2.00; Xerox $4.00. 74 pages.

EXPERIMENTAL AND THEORETICAL STUDY OF LOW-TEMPERATURE INTERNAL FRICTION IN COPPER

(L. C. Card No. Mic 59-1196)

Victor Kenneth Paré, Ph.D.
Cornell University, 1958

Measurements were made of internal friction in cold-worked copper single crystals as a function of temperature from 4^0K to 300^0K, at vibrational strains ranging from 10^{-7} to 2×10^{-5}. Flexural vibration was used, at frequencies in the neighborhood of 5 kilocycles. The measurements were made in a cryostat designed and built for the purpose.

Particular attention was given to the Bordoni peak, a prominent maximum at about 80^0K in the curve of internal friction versus temperature, apparently representing a thermally activated relaxation process. Since the height of the peak is sensitive to both cold working and impurity content, while the temperature T_{max} at which it occurs is nearly constant, it is assumed that the relaxation process involves dislocations bound by an intrinsic lattice barrier, the periodic potential which gives rise to the Peierls force.

The barrier energy, or activation energy, varies slightly with the impurity content and degree of deformation of the sample, so that comparison on a plot of log (frequency) versus $1/T_{max}$ of the data of various investigators does not give consistent values for the activation energy. The best value appears to be 0.18 e.v. It was found that even when the same sample is measured at different frequencies, part of the change of T_{max} with frequency may be associated with the change of spatial distribution of the oscillating stress in the sample from one mode of vibration to another. It was also found that T_{max} is independent of the amplitude of vibration throughout the range studied, and that the internal friction in rolled copper single crystals may change considerably during room-temperature aging.

The experimental results were discussed in terms of a theory of Seeger, Donth, and Pfaff, which gives the temperature-dependent frequency with which dislocations jump over the barriers of the Peierls potential, under the influence of thermal stress waves and an applied "measuring stress." To provide a valid comparison with the experimental results, a complete relaxation model for the dislocations was worked out, taking into account the existence of static internal stresses and of a distribution in the dislocation lengths between pinning points, and using the jump frequency given by the theory of Seeger, Donth, and Pfaff.

It was found that if the internal stresses are large enough, there will be, as observed, no variation of T_{max} with amplitude. However the model yields a relaxation peak which is much narrower than the observed Bordoni peak.

Microfilm $2.40; Xerox $8.40. 182 pages.

THE RECOIL OF SURFACE ADSORBED ATOMS AFTER ELECTRON CAPTURE

(L. C. Card No. Mic 59-557)

Roy Norman Peacock, Ph.D.
University of Illinois, 1958

When a nucleus decays by electron capture, neutrino emission causes the atom to recoil.(1) The recoil energy, E_r, is

$$E_r = Q^2/2Mc^2$$

where Q is the disintegration energy, M is the mass of the atom, and c is the velocity of light. To illustrate the magnitudes involved, when the atomic weight is 100, and Q is 1 Mev, then E_r is 5.4 ev.

Surface adsorption energies are also a few electron volts, and in many cases recoil energies are sufficient to free a decaying atom from a surface source. A recoiling atom is described by its energy, momentum, charge, and nuclear polarization. If the recoiling particle is radioactive it may be detected and these quantities studied. Since the recoils are perturbed by the surface as they leave it, the altered properties provide a method of studying the surface.(2)

Problems in solid state physics that may be investigated include the surface adsorption energy of the recoil atom, the angular distribution of the recoils as related to surface properties, the coverage of the surface by foreign adsorbed material, and diffusion. In nuclear physics, some experiments using recoils were recently suggested to determine the dominant interactions in beta decay.(3)

In the present experiments three isotopes have been used: Cd^{107}, Ga^{67}, and Zn^{62}. Recoil yields of about 60% were obtained with Cd^{107} sources. This high yield verified the cleanliness of the isotope techniques used, and the constancy of the yield over a period of several hours showed that the pressure of adsorbable material in the vacuum system was negligible.

An attempt has been made to show that the recoils from Zn^{62} are polarized. To detect an effect it would be necessary to preserve the polarization of the daughter nuclei (Cu^{62}) from the time that they are formed until they decay or for about 10 minutes if sufficient counts are to be obtained. The observed negative results probably mean that efforts made to secure a long nuclear relaxation time have failed. If polarized recoils can be found, they could be applied to studies of surface nuclear relaxation times.

The present experiments are improved over earlier works in that ultra-high vacuum techniques have been applied. Although only preliminary results have been reported, the possibility of making recoil surface studies under reproducible conditions has been shown. New applications of recoil methods to the measurement of surface binding and nuclear relaxation time have been suggested.

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Microfilm $2.00; Xerox $3.80. 68 pages.

UNDERWATER SOUND REFLECTION FROM RANDOMLY ROUGH SURFACES

(L. C. Card No. Mic 58-7662)

Joseph Mason Proud, Jr., Ph.D.
Brown University, 1958

A model study of the reflection of underwater sound from randomly rough surfaces has been undertaken. The radiation wavelengths and the dimensions of the surface irregularities were scaled down from typical sonar wavelengths and sea surface roughness dimensions. A directional source insonified the surfaces under study and the reflected radiation field was examined in detail with a small scanning microphone. The reflecting surfaces were constructed of molded cork to yield the desired roughness profiles. The surface amplitude variations were generated by straight line elements perpendicular to the plane of incidence, effectively reducing the problem to two dimensions. A roughness time dependence was simulated by the slow, step-wise motion of the surfaces through the incident beam.

The Eckart theory for all radiation wavelengths was applied to a study of the spectral reflection coefficient using one of the surfaces (Surface I). This surface was constructed from a series of step-amplitudes of equal width (1 cm). The minimum amplitude step (limited by the thickness of available sheet cork) was 1/32 in. The distribution of the step-amplitudes about the average amplitude was Gaussian. The arrangement of the steps along the surface was such that there was little correlation (on the average) between neighboring surface amplitudes. Good agreement was obtained with theory for the variation of specular reflection coefficient with radiation wavelength, even though the condition that the surface slope be small everywhere was clearly violated.

Surface II was designed to provide a surface correlation function which could be treated easily in the Eckart theory for long radiation wavelength. A method was developed whereby it was possible to determine the surface correlation function and r.m.s. amplitude through an analysis of the angular variation of the reflected sound field. It was found that all the information about the surface could be obtained by observations of the back scattering. The surface correlation, although simple and representable approximately by an analytic function, was similar in form to that observed for the sea surface.

A third phase of the work was devoted to an experimental investigation of grazing reflection. When the incident beam has finite angular width, it was found (using the sinusoidal surface, Surface III) that the various grating orders vanish very gradually at grazing reflection as the radiation wavelength increases. The beam reflected in this region was seriously distorted, a fact that is not predictable by existing theory. This is in contrast to the case of incident plane waves where grating orders appear and disappear suddenly as the radiation wavelength is varied.

Microfilm $2.00; Xerox $5.60. 114 pages.

THE VELOCITY OF LIGHT IN UNIFORMLY MOVING FRAMES

(L. C. Card No. Mic 59-1456)

Frank Robert Tangherlini, Ph.D.
Stanford University, 1959

It is shown, using the techniques of general covariance, that it is possible to obtain the results of special relativity working with a line element corresponding to a coordinate system in which there is an asymmetry in the velocity of propagation of light. In this coordinate system clocks have been synchronized with instantaneous or "absolute" signals in contrast with the synchronization procedure employed in special relativity. It is shown that the transformation connecting this frame and a Lorentz frame at rest with respect to it is the Lorentz "local time" transformation. The basic result is that in this coordinate system the out and back times for light to traverse a given distance are in general different and depend upon the absolute velocity of the frame; but the total time for the round trip does not depend upon this velocity and is the same as that obtained by a Lorentz (i.e., relativistic) observer. It is also shown that if the measurements of the velocity of light are made one-way by employing two clocks which have been synchronized together and then slowly separated, one obtains the value c for the velocity of light independently of the absolute velocity of the frame.

Because of the absolute character of this coordinate system, the transformation connecting it with the absolute frame is called the absolute Lorentz transformation (or simply, A.L.T.). Using the A.L.T. new expressions for relative velocity and the velocity of light in a moving refractive medium are obtained which reduce to the results of special relativity when the different methods of synchronization are taken into account. Further applications of the A.L.T. are given in connection with particle mechanics, electrodynamics, improper transformations, and relativistic quantum mechanics. In connection with the latter it is shown that the covariant energy levels in an A.L.T. frame are the same as those in the corresponding Lorentz frame, and that in fact the two frames are related by a unitary transformation.

For the purposes of this investigation the absolute signals which have been used in obtaining the A.L.T. are employed only as a kinematic device to interpret the transformation and no attempt is made to construct a dynamics of such "signals." However it is shown that there exist faster-than-light (or "superlight") frames as solutions to the field equations of general relativity (throughout the paper only solutions in the absence of sources are considered, i.e., the investigation is carried out solely in Cartesian frames) which could conceivably provide the basis for the dynamics of such signals. Some of the objections to such frames from the standpoint of special relativity are critically examined. The kinematic implications of superlight signals for relativistic causality are investigated and it is shown that although such signals propagate backwards in time for an infinite class of Lorentz observers, this is due to the method of synchronization rather than a genuine violation of causality when appropriate mathematical criteria for the latter are set up.

In an appendix to the main text, the concept of an absolute frame is discussed from the standpoint of phenomena observed in rotating frames, and it is argued that since general relativity does not contain Mach's principle, these phenomena are more simply explained from the standpoint of an absolute frame. Thus using the expression for the propagation of light found from the A.L.T., it is possible to calculate very simply the effect observed in the Michelson-Gale experiment, without going outside the conceptual framework developed for uniformly moving frames.

Microfilm $2.00; Xerox $6.60. 140 pages.

PHYSICS, ELECTRONICS & ELECTRICITY

IONS IN NITROGEN

(L. C. Card No. Mic 59-1351)

Mykola Saporoschenko, Ph.D.
Washington University, 1958

Chairman: Professor Robert N. Varney

N^+, N_2^+, N_3^+, and N_4^+ ions have been identified in nitrogen gas by use of a mass spectrometer operated with the ion source in the pressure range from 10^{-3} mm Hg to 0.6 mm Hg.

Appearance potentials occur at 15.5 ± 0.2 ev for N_2^+, at 15.8 ± 0.3 ev for N_4^+, at 22.1 ± 0.5 ev for N_3^+, and at 24.2 ± 0.4 ev for N^+; N_3^+ ions thus are formed only at much higher electron energies than N_2^+ but still at 2 ev less energy than N^+.

It is believed that the N_4^+ is formed by the process $N_2^+ + N_2 \rightarrow N_4^{+*}$ (excited vibrationally) and the N_3^+ is formed by the process $N_2^{+*} + N_2 \rightarrow N_3^+ + N$ where N_2^{+*} is an excited ion.

N_4^+ and N_3^+ currents decrease with increasing E/p in the source suggesting that they may be dissociated by molecular impacts. The N_4^+ ions are considerably more readily lost than the N_3^+ ions.

Since the formation of N_3^+ must necessarily release a nitrogen atom, this process constitutes a form of dissociation of N_2 which may account for the value of the dissociation energy of 7.38 ev found by some methods.

Microfilm $2.00; Xerox $3.00. 58 pages.

THE EFFECT OF TEMPERATURE ON HIGH-VACUUM ELECTRICAL CONDUCTION

(L. C. Card No. Mic 59-1352)

Edmund Kugler Storms, Ph.D.
Washington University, 1958

Chairman: Samuel I. Weissman

The process for the transfer of charged particles between "clean" electrodes in vacuum was investigated by using a spherical system in which a beta emitter ($Sr^{90} + Y^{90}$) was used to generate a high positive potential on the center electrode. Previous work had revealed a region in which the value of the voltage limit was very sensitive to temperature, and, at low temperatures, a region in which the voltage was almost independent of temperature. Conduction by the quartz anode support, Schottky current from the cathode, changes in positive ion emission rate and changes in the positive ion spectrum were considered in order to explain this behavior.

Support conduction was found to account for almost all of the voltage change at high temperature.

The positive ion spectrum was examined to determine if more massive ions were emitted at the higher temperatures. Only three ion peaks of mass ~170, ~18 and 1 were found in significant abundance. These peaks showed no gross changes that could be related to the temperature.

From a measured work function of 2.62 ev and a field magnification factor of 44.4, the Schottky current from the glass cathode was calculated and found to be negligible.

A continuous source of positive ions was found to result from the bombardment by electrons and perhaps negative ions pulled from the support during charging. In a dirty system and above room temperature these negative particles provide the basis for a multiplication process; in a very clean system and at low temperatures the exchange process becomes more self-sustaining.

No positive ions have been found to result from the beta flux. There is even the suspicion that the action of the beta flux on the insulating oxide film may decrease the film resistance so that the ionized surface may be neutralized more quickly.

BIOGRAPHICAL DATA

Date of Birth: April 22, 1931. Place of Birth: York, Pennsylvania.
Undergraduate Study: Pennsylvania State University, 1949-1953.
Graduate Study: Washington University, 1953-1958.
Scholastic and Professional Experience: Research Assistant, Los Alamos Scientific Laboratory, summers of 1955 and 1956; Teaching Assistant, Washington University, 1954-1955; Instructor in Engineering Drawing, Washington University, January 1954 to June 1954, and 1955 and 1956.
Membership in Scholastic and Professional Societies: Sigma Xi.
Honors: General Atomics Fellow, 1956 to 1958.

Microfilm $2.00; Xerox $4.00. 72 pages.

DIELECTRIC COATED SPHEROIDAL RADIATORS

(L. C. Card No. Mic 59-597)

Walter LeRoy Weeks, Ph.D.
University of Illinois, 1958

Analytical methods are presented for the determination of the changes in the radiation patterns brought about by dielectric coatings on spheroidal radiators. A description is given of a machine computation system which makes the analytical results useful. This system includes a program for the semiautomatic calculation of the radiation patterns of spherical radiators, a practical method for the determination of the eigenvalues of all of the orders of the spheroidal functions which are needed to obtain covergent representations, and a new method for the calculation of the spheroidal "radial" functions. Numerical results are included for spheres and prolate spheroids, having sizes of the order of several wavelengths, which are excited by axially symmetric slots.

The effects of the dielectric coating are most marked when the excitation is latitudinally asymmetric. One typical effect is an increase in radiation in the general direction of the poles. For spherical radiators, the important effects show a complicated dependence on the size of the radiator and the value of the permittivity. Comparison of the patterns of the coated prolate spheroidal radiators herein calculated with the patterns of spherical radiators indicates that the effects are similar in both cases.

Microfilm $2.10; Xerox $9.40. 160 pages.

DIFFUSION OF SILVER, COPPER, COBALT AND IRON IN GERMANIUM

(L. C. Card No. Mic 59-598)

Ling Yun Wei, Ph.D.
University of Illinois, 1958

In this study, the diffusion properties of silver, copper, cobalt and iron in germanium are investigated. Radiotracer techniques are used throughout. We found that: (1) In most cases, the penetration curves are exp (-x/L) in form. The diffusion length (L) increases with time. (2) In high dislocation crystals (about 10^5 pits / cm^2), the surface concentration rises with time up to a certain time limit. (3) In some cases, the penetration curves show great irregularities. (4) The diffusivities of these elements in Ge are very great, in the range of 10^{-5} - 10^{-7} cm^2/sec at temperatures around 800° C. (5) The diffusivities are higher in low dislocation (less than 10^3 pits / cm^2) than in high dislocation (around 10^5 pits / cm^2) crystals. (6) The solubilities in Ge are very small. For Cu, the solubility is about 4 x 10^{16} atoms/cc at 800°C. For Ag, Co, and Fe, the concentrations are in the range 10^{13} - 10^{14} /cc. (7) The activation energy of cobalt diffusion in Ge is found to be about 1 ev., nearly the same as those of Ag, Ni, and Fe diffusion, as obtained by other workers.

The above findings may be summarized as follows: (a) Diffusion does not follow Fick's law. (b) There is a fast diffusion rate. (c) The solubility is very low. (d) Diffusion is structure sensitive. All these characteristics are in sharp contrast with those observed in diffusion of Group III and V elements in Ge or Si.

We believe that this peculiar sort of diffusion is most likely a double-stream process. When two streams move along and have nonequilibrium exchange of flow, the composite stream will in general not follow Fick's law. The solution of differential equations for this process does show the behaviors (1) and (2) as stated above. Since interstitials and weakly bounded substitutionals are involved in this double-stream process, the fast diffusion rate is easily understood. As "trapping" of diffusing species possibly occurs at imperfections and at impurities, this may explain the irregularities in penetration curves and furthermore may be considered as one of the causes of double-stream process (the species may be either trapped or free).

Microfilm $2.00; Xerox $5.00. 96 pages.

PHYSICS, METEOROLOGY

AN INVESTIGATION OF THE VARIABILITY OF SURFACE-AIR TEMPERATURE OVER THE NORTH ATLANTIC OCEAN

(L. C. Card No. Mic 59-675)

Stanley L. Rosenthal, Ph.D.
The Florida State University, 1958

Surface-air temperature records at nine North Atlantic Ocean-Vessel Stations are investigated with respect to diurnal and interdiurnal variations. Analysis of the periodic

diurnal variation of temperature yields some interesting results concerning vertical heat balances in the lowest atmospheric layers over the oceans. Aperiodic diurnal ranges of temperature, which are the actual diurnal ranges which would be experienced by observers, are presented in frequency distribution form. Frequency distributions of daily maximum (minimum) temperatures, mean daily temperatures, 1-day changes of mean daily temperature, and 3-hourly temperatures are presented and discussed. It is found that strong linear correlations exist between the means and the per cent points of these distributions. This suggests the possibility that regression equations, which give estimates of the entire frequency distribution from estimates of the means of the distribution, can be developed. The procedure for doing this is illustrated by use of distributions of aperiodic diurnal ranges of temperature and distributions of 3-hourly temperatures as examples.

It is also found that frequency distributions considered here have the property that the means and medians are within 1F of each other. Also, frequency distributions of mean daily temperature, and of 3-hourly temperatures, are found to approximate the normal curve in certain respects.

Several other properties of the various frequency distributions are discussed. Where possible, brief physical explanations are offered for computational results. Comparisons are made with similar studies which have been conducted for land stations and with the descriptions of marine climates found in the standard references.

Microfilm $4.05; Xerox $13.60. 313 pages.

CHARACTERISTICS, ANALYSIS, AND USES OF TROPOPAUSE CHARTS

(L. C. Card No. Mic 59-921)

James Robert Stinson, Ph.D.
St. Louis University, 1958

Although the tropopause was discovered around the beginning of the twentieth century and most of its basic characteristics known within a few years of its discovery, little or no agreement has been reached as to how the tropopause should be defined or analyzed.

Stratospheric sinks, tropopause cold crests, jet streams and constant-pressure cold-rims associated with the tropopause are all recognized in meteorological literature. These features of the tropopause region have one feature in common, namely, a reversal in direction and discontinuity in the thermal-wind across the tropopause. Detailed study of the isotherm patterns on tropospheric-stratospheric constant-pressure charts demonstrates that, though the thermal-wind reversal and discontinuity generally occur together, there are frequent cases where the reversal does not occur at the tropopause. In this latter case the distinguishing feature of the tropopause is the discontinuity of the thermal-wind. Thus, the tropopause is defined in terms of the thermal-wind discontinuity alone. This tropopause is named "the thermal-wind tropopause."

From investigations of the tropopause above regions of strong 500 mb wind speeds it is concluded that the tropopause structure is relatively simple in these regions and is generally easy to identify from individual soundings. It is further concluded that the tropopause is single-valued and continuous through jet streams. A stability equation for the slope of discontinuity surfaces shows that surfaces such as the tropopause have their greatest slope when the discontinuity of the thermal-wind and the reversal of the thermal-wind occur together at constant-pressure cold-rims. The stability equation gives an explanation for the nearly flat nature of the tropopause surface in the centers of cold and warm core systems, and for its maximum slope in jet streams.

Rules are given to aid in the selection of the thermal-wind tropopause from individual soundings and the use of sounding pairs is suggested for difficult cases. The analysis of the tropopause chart should be performed with the aid of a good isotherm analysis for a completely tropospheric constant-pressure surface. The 500 mb chart has been found satisfactory for most purposes. The tropopause will generally be at low altitudes (high pressure) above cold areas and at high altitudes (low pressure) above warm areas.

On the completed tropopause chart the isotherms and isobars will have similar patterns and gradients. The isobars from the tropopause chart provide proper tropopause intercepts for the tropospheric-stratospheric constant-pressure charts, and the charts show remarkable continuity in both space and time.

The thermal-wind tropopause chart has many forecasting applications affecting most areas of meteorology.

Microfilm $2.00; Xerox $5.80. 116 pages.

PHYSICS, NUCLEAR

RADIATIVE CAPTURE OF ALPHA PARTICLES AND DEUTERONS AT ENERGIES UP TO 40 MEV

(L. C. Card No. Mic 59-1213)

James Bryan Ball, Ph.D.
University of Washington, 1958

The excitation functions for the radiative particle capture of medium energy alpha particles and deuterons have been studied in several elements throughout the periodic table using radiochemical techniques.

The reaction $Ni^{58}(\alpha,\gamma)Zn^{62}$ was studied in the presence of the reaction $Ni^{60}(\alpha,2n)Zn^{62}$ by the use of enriched isotopes and by the development of a technique for examining the angular distribution of the recoiling reaction products.

In each case, where complete excitation functions were obtained, the cross section rises sharply to a maximum at a nuclear excitation energy of about 20 Mev and then falls quite rapidly above this energy.

The excitation functions examined and their maximum cross sections are: $Ba^{138}(d,\gamma)La^{140}$, 68 ± 7 microbarns; $Xe^{136}(\alpha,\gamma)Ba^{140}$, 58 ± 7 microbarns; $Ni^{58}(\alpha,\gamma)Zn^{62}$, 410 ± 25 microbarns; $A^{40}(d,\gamma)K^{42}$, 85 ± 15 microbarns; $N^{14}(\alpha,\gamma)F^{18}$, 2.2 ± 0.4 millibarns. The $He^{3}(\alpha,\gamma)Be^{7}$ reaction has been examined up to an excitation energy of 18 Mev. At this energy the cross section has risen to a value of 110 ± 35 millibarns.

The formation cross section arising from the Coulomb

barrier penetration factor is found to have a very large effect on the probability of radiative particle capture in every case except helium and nitrogen. When the excitation functions are corrected for the effect of the formation cross section, the resulting curves no longer exhibit the sharp maximum present in the original excitation functions. A semi-quantitative calculation is performed to show that the observed magnitude and behavior of the capture cross section is consistent with the compound nuclear model.

Microfilm $2.00; Xerox $6.60. 136 pages.

INELASTIC SCATTERING OF 40 MEV PROTONS FROM VARIOUS ELEMENTS

(L. C. Card No. Mic 59-1256)

Sheau-Wu Chen, Ph.D.
University of Minnesota, 1958

Measurements were made at a proton energy of 40 mev for the angular distributions of the inelastically scattered protons which excite the 4.4, 7.5 and 9.6 mev states of C^{12}, the first excited state of Li^6, the second excited state of Li^7, and the continuous energy spectra of the outgoing protons from copper, tin, and lead at various angles. The proton beam was from the second section of the Minnesota Linear Accelerator.

For the discrete state experiments, a NaI crystal, coupled with a lucite light pipe to a photomultiplier was used as the detector. A 20-channel pulse height analyzer was used to take the spectra. The same equipment was used to measure the high energy part of the continuous energy spectra. For the low energy part of the spectra (from 5 mev to 20 mev), a proportional counter was used in front of the E-crystal. The pulses from the proportional counter were used to gate the pulse height analyzer. Therefore only coincident pulses in the E-crystal could be counted. The purpose was to eliminate the low energy gamma ray and neutron background. The deuteron and triton contamination in the energy spectra has been substracted out by using a particle identification system which was able to detect deuterons and tritons with energies higher than 15 mev.

The results of the discrete state experiments have been compared with the current direct interaction theories. It was found that the direct interaction process, calculated with plane waves for the incoming and outgoing particles and a zero range approximation for the two body interaction explains the main features of the excitation but does not give quantitative information on the wave functions of the nuclear states. To obtain precise knowledge about the nuclear excited states from the angular distribution of inelastically scattered protons, a more sophisticated distorted wave and finite range approximation must be used in the analysis. Even for lithium at 40 mev the distortion due to the nuclear potential and coulomb forces can not be neglected. The distorted wave calculation has been made only for the 4.4 mev state of C^{12}. This fits the experimental curve reasonably well except that at backward angles the experimental cross sections were considerably larger than the theoretical prediction. The small cross sections at backward angles can possibly be explained by a compound nuclear process or multiple scattering in the nucleus.

The angular distributions of outgoing protons with various energies from Cu, Sn and Pb were plotted. For the higher energy protons, the angular distribution peaks strongly in the forward direction. The angular distribution becomes more and more isotropic as the proton energy decreases. For tin, the angular distribution becomes roughly isotropic at 7 mev. In the case of lead, the coulomb barrier is higher, and thus the lowest energy protons allowed are still not low enough in energy to be due entirely to a compound nucleus process which would produce isotropy. Microfilm $2.00; Xerox $5.80. 117 pages.

LOW-LYING ENERGY STATES OF HOLMIUM-165 AND THULIUM-171

(L. C. Card No. Mic 59-1436)

Frederick Pitkin Cranston, Jr., Ph.D.
Stanford University, 1959

An experimental study has been made of the decay of two highly-deformed neutron-rich nuclides: $_{66}Dy^{165}$ and $_{68}Er^{171}$. Use was made of beta and gamma scintillation spectrometers, a magnetic lens spectrometer, and 180° permanent magnet spectrographs. On the basis of coincidence studies, intensity data, internal conversion coefficients, and the measured transition energies, consistent level schemes are proposed for $_{67}Ho^{165}$ and $_{69}Tm^{171}$. The scheme for $_{67}Ho^{165}$ has excited states at 0.0948, 0.361, 0.515, 0.555, 0.715, 0.997, and 1.079 Mev. The scheme for $_{69}Tm^{171}$ has excited states at 0.0051, 0.1167, 0.1291, 0.4251, 0.636, 0.688, 0.744, 0.921, and 1.008 Mev. Most of the observed states are identified with the appropriate orbitals of the Nilsson energy level diagram, and the experimental transition probabilities are examined in terms of the asymptotic selection rules for strongly deformed nuclei.

Microfilm $2.00; Xerox $5.00. 98 pages.

A STUDY OF THE DIRECT REACTION D(d,n)He^3 WITH 8 MEV. DEUTERONS

(L. C. Card No. Mic 59-1344)

Wilfried Adolf Wolfgang Daehnick, Ph.D.
Washington University, 1958

Chairman: John M. Fowler

The object of this thesis was the quantitative investigation of the direct nuclear reaction D(d,n)He^3 at a residual deuteron energy of E_d = 8.4 Mev. The absolute differential cross sections for the neutrons from this reaction were measured. A plastic crystal was used as the neutron detector, and deuterium gas at 200 PSI as a target. The measured cross sections were compared with semi-theoretical predictions based on the data published by Brolley [Br57], and excellent agreement was found. The cross sections were also fitted by stripping curves. "Exchange stripping" and interference terms were considered, in addition to "direct stripping" of the incident deuteron. A stripping radius of $R_0 = 7 \times 10^{-13}$ cm was used.

In a separate experiment the polarization of the D(d,n)He^3 neutrons was measured. Helium gas, which was contained in a double proportional counter with telescopic properties, was used as a polarization analyzer. The polarization was calculated from the right-left scattering asymmetry measured by this polarimeter. Background errors were eliminated by requiring triple coincidences for the desired scattering events, and by counting direct and chance coincidences simultaneously. Errors, due to small asymmetries of the apparatus, were greatly reduced by the use of a particular counting procedure. The maximum polarization found was $P_{max} = (-12 \pm 4)$ per cent. Qualitative theoretical predictions for the neutron polarization are discussed, and a probable angular dependence of the polarization at 8 Mev is derived from the comparison of these predictions with the data obtained.

In the course of this research a 120 channel pulse height analyzer, an improved gas target, and a triple coincidence polarimeter were built. Some studies of the nonlinearity of plastic crystals and the properties of high pressure proportional counters were made, and the results are reported. Microfilm $2.00; Xerox $5.60. 113 pages.

[Br 57] J. E. Brolley, Jr., T. M. Putnam, and L. Rosen Phys. Rev. 107, 821 (1957).

EINSTEIN MODEL THERMAL NEUTRON SCATTERING

(L. C. Card No. Mic 59-892)

Robert Michael Delaney, Ph.D.
St. Louis University, 1958

The Einstein model for a material is applied to thermal neutron scattering using the Born approximation together with the Fermi pseudo-potential. No approximations are made in obtaining the differential and total cross section expressions for scattering by crystals or liquid-like materials. Comparison is made with experiment for below Bragg cut-off scattering by beryllium, aluminum, and magnesium, showing that the Einstein model has a wider range of applicability in neutron scattering than previously thought.

The Einstein temperatures of the three materials considered, as determined by neutron scattering, are used to calculate the Young's moduli of the materials; a fair agreement is obtained with values obtained by direct measurement.

An electronic computer is used to calculate the total scattering cross sections of the three materials considered for relatively high neutron energies. The computations show the correct limiting values are approached by the theoretical expressions.

Microfilm $2.00; Xerox $4.20. 77 pages.

CHARGE-DEPENDENT CORRECTIONS TO PION NUCLEON SCATTERING

(L. C. Card No. Mic 59-517)

Daniel Mordecai Greenberger, Ph.D.
University of Illinois, 1958

If account is taken of the mass difference between neutral and charged pions and of the possibility that the three coupling constants (π^0 - p, π^0 -n, $\pi^\pm$ - nucleon) may differ, then the pion-nucleon system no longer conserves isotopic spin. This effect has been investigated using Chew-Low theory with a p-state interaction. For each J value there are ten scattering amplitudes, replacing the two of the charge independent case. Only eight of these amplitudes are independent due to time reversal invariance. They are determined as solutions to a set of linear integral equations which may be solved approximately in the one meson approximation. Corrections to the differential cross sections are then calculated. These corrections go through a maximum at about 125 Mev and can affect the magnitude of the π^- cross section by as much as 30% in this region, as well as the slope of the π^- cross section in the region 125-170 Mev. Microfilm $2.00; Xerox $5.00. 99 pages.

A STUDY OF THE FISSION GASES FROM THE WATER BOILER REACTOR

(L. C. Card No. Mic 59-336)

Harold Augustus Lamonds, Ph.D.
North Carolina State College, 1958

Supervisor: Arthur Walter Waltner

The gamma-emitting activity in the off-gas of the Raleigh reactor was studied. Air was passed through the reactor core to extract the fission gases and the off-gas stream was then passed through a cell mounted near a scintillation detector. Purge flow rates up to 2000 cc/min were used resulting in total transit times as short as 33 seconds. Measurements were made on both the fission gases and their daughter products.

Curves are given showing the expected specific activities of the fission gases and their daughter products. These were calculated on the IBM 650 computer using data found in the literature. Measurements were made on the gross decay of gamma-emitting isotopes of both gases and their daughter products. The results of these measurements are compared with calculated values. The relationship between gas evolution rate and reactor power is also investigated. A computer program was developed for obtaining the "least squares best fit" of a sum of exponentials to experimental data. This was used in analyzing decay curves.

The investigation produced substantial evidence of the existence of short-lived gamma-emitting isotopes not tabulated in the literature. Gamma-ray spectra taken of the gases and their daughters help to substantiate this postulate. Values are given for the average transit time of fission gases in the reactor fuel solution. A description is given of the instrumentation developed for automatic measurement of decay curves.

Microfilm $2.00; Xerox $5.60. 115 pages.

FAST-NEUTRON CAPTURE CROSS SECTIONS OF INTERMEDIATE AND HEAVY NUCLEI

(L. C. Card No. Mic 59-1412)

Myron Gordon Silbert, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor H. H. Barschall

Fast neutron capture cross sections were measured as a function of energy, by an activation method, in the neutron energy range 0.16 to 6.2 Mev. The capture cross sections of Co^{59} (to the 10.5-min state of Co^{60}), Ga^{71}, Br^{79}, Br^{81}, Sr^{86} (to 2.8-hr state), La^{139}, Pr^{141}, Nd^{148}, Nd^{150}, Eu^{151} (to 9.2-hr state), and Ho^{165} (to 27.2-hr state) were studied in the neutron energy range 0.16 to 2.5 Mev; the capture cross sections of Cu^{65}, Br^{79} (to 18-min state), Mo^{100}, In^{115} (to 54-min state), I^{127}, and Sm^{154} were studied in the neutron energy range 3.3 to 6.2 Mev. The neutron energy spreads were about 50 kev below 0.60 Mev, 170 kev between 0.60 and 2.5 Mev, and 380 kev above 2.5 Mev. The activity induced by fast neutrons was measured and compared to that induced by thermal neutrons. The fast and thermal neutron fluxes were compared with a U^{235} fission counter. Knowledge of the thermal neutron activation cross section and the energy dependence of the U^{235} fission cross section allows calculation of the fast neutron activation cross section. The experimental results are presented graphically.

Microfilm $2.00; Xerox $4.80. 94 pages.

PHYSICS, SOLID STATE

PARAMAGNETIC RESONANCE AND RELAXATION OF TRAPPED HOLES

(L. C. Card No. Mic 59-486)

Theodore Grant Castner, Jr., Ph.D.
University of Illinois, 1958

Paramagnetic relaxation studies of trapped holes in pure KCl, KBr, LiF, and NaCl single crystals were made in the liquid nitrogen temperature range. The trapped holes (V_K centers) were formed by irradiation with X-rays at liquid nitrogen temperature. An X-band bolometer detector balanced mixer paramagnetic resonance spectrometer was used to obtain saturation curves of the absorption signal, $\chi''H_1$. The saturation curves spanned a 60 DB sample cavity power range and were taken at 78°K for the most part although some saturation curves were also obtained at 117°K. Portis' theory for the saturation of inhomogeneously broadened lines has been extended without making the assumption the individual spin packet is much narrower than the Gaussian envelope width of spin packets. The theory was based on a Lorentzian shaped individual spin packet. From the theory it was possible to extract values of T_2, $\sqrt{T_1 T_2}$, and T_1 from V_K center saturation curves. In Portis' F center work only the value $T_1 T_2$ could be obtained. Experimental values of T_2, $T_1 T_2$, and T_1 were obtained for LiF and KCl for the different hyperfine lines for θ equal 0°, 45°, 60°, and 90° (θ is the angle between the molecule ion complex axis and the external magnetic field, H_0). For KBr only values of $\sqrt{T_1 T_2}$ were obtained. The results indicated that $T_1 \neq T_2$ contrary to what has been assumed by previous investigators. For KCl T_1 is approximately 6 to 9 times T_2 while for LiF T_1 varies from two to three orders of magnitude times T_2 depending on the hyperfine line. It is shown that effective cross relaxation can contribute to the T_2 of the individual spin packet without contributing to T_1, the longitudinal relaxation time.

Detailed calculations of spin lattice relaxation times were made for the V_K center for both the direct and Raman processes at 4°K and for the Raman process at 78°K. A detailed model of the molecule ion complex and the host lattice was formulated so that spin-lattice relaxation could be broken into three component types: lattice modulation of the crystalline field which the hole "sees"; rotation of the molecule ion complex relative to the external magnetic field, H_0; and vibration of the molecule ion complex changing the internuclear distance and the % s and p orbital in the ground state wave function. It was possible to show at 78°K the spin-spin interaction between V_K centers was completely negligible implying a spin temperature could not be defined and that each V_K center relaxed independently to its immediate surrounding "lattice". Calculations were made for two spin flip mechanisms, the spin-orbit interaction and the hyperfine interaction for $\theta = 0°$, $\theta = 90°$, and for an arbitrary 0 when possible. Comparison of the calculated T_1's with the experimental T_1's at 78°K and 117°K indicated satisfactory agreement. None of the Raman cross relaxation mechanisms considered, however, could account for the anomalously short T_2's observed.

A discussion of the effect of the relative magnitude of the direct electronic relaxation times, the nuclear relaxation times, and the mutual electron-nuclear cross relaxation times on a steady state double resonance experiment is given. Microfilm $2.55; Xerox $8.80. 193 pages.

ELECTRICAL PROPERTIES AND THE SODIUM, POTASSIUM, AND CHLORIDE CONTENT OF INTESTINAL SMOOTH MUSCLE CELLS

(L. C. Card No. Mic 59-469)

Lloyd Miller Barr, Ph.D.
University of Illinois, 1958

The ionic basis for membrane potentials in smooth muscle, the spread of activity from fiber to fiber were investigated and the resistance of the cell membrane was measured. The amounts of water and sodium, potassium, and chloride ions contained in the serum and the circular smooth muscle layer of the cat ileum were measured. The extracellular volume was calculated from the amount of inulin permeating the whole muscle to be 101.7 cc/liter. Intracellular concentrations were calculated as follows: sodium ions (64.4 mEq/Kg fiber H_2O), potassium ions (105.1 mEq/Kg fiber H_2O) and chloride ions (74.5 mEq/Kg fiber H_2O). The ionic concentration gradients in this tissue were consistent with the hypothesis that the membrane potentials are in fact diffusion potentials.

Propagation of activity was observed to occur to all parts of 4X6 cm sheets of nerve-free intestinal muscle. The average velocity of propagation in a direction parallel to the fiber axes was 5.7 ± 1.8 cm/sec; while, in the direction perpendicular to the fiber axes the average propagation velocity was only 0.41 ± 0.17 cm/sec. When muscle sheet was stimulated at a corner, a band of activity parallel to the fiber axes moved across the muscle sheet. Externally recorded repetitive action potentials maintained their complex waveform for long periods of time. This result implies some fixed relations between the times of excitation of groups of cells. These relations undoubtedly have an anatomical basis; perhaps, in the fasciculi and bands described in the literature.

Measurements of the resistance between the interior of cells and the bathing solution averaged 103.8 megohms and measurements of the resistance between the cell interiors of two cells less than one mm apart averaged 236.0 megohms. A specific membrane resistance of 1100 ohms cm^2 has been calculated on the assumption that the cells are discrete, 100 micra long and 6 micra in diameter. This value is within the range of values reported for striated muscle membrane. The resistance between the interiors of two cells was almost exactly twice the resistance between the interior of one cell and the outside solution. Low resistance pathways between the cell interiors of intestinal smooth muscle cells are therefore not indicated. The bridges seen by some electron microscopists are crossed by single membranes; these must have a very high resistance and hence cannot provide pathways for current between cells.

Microfilm $2.00; Xerox $4.60. 86 pages.

AUREOMYCIN IN THE DIET AND ITS EFFECT ON ACTIVITY AND WEIGHT INCREMENT OF MALE WEANLING ALBINO RATS

(L. C. Card No. Mic 59-1052)

Robert O. Capella, Ph.D.
New York University, 1958

Chairman: Professor Malcolm E. Little

The purpose of the study was to determine whether there was any effect on activity by the inclusion of aureomycin in the diet of the rat. Since it was known that the antibiotic could affect the gain in weight of animals, weight increment was included as one of the variables to be studied as was food efficiency. The correlation between the activity of the animals and their weight gain was also analyzed.

Since 1946, when the first report of a growth stimulatory effect by an antibiotic apparently was made, many experiments have been performed with aureomycin, as well as other antibiotics, to observe not only the effect on growth, but other biological processes also. Because of the results, significant and positive in many instances, it was hypothesized that aureomycin could cause an effect on activity, also a biological process.

The experimental and control animals were male weanling albino rats of the Wistar strain and the experimental period was the four week period from weaning to approximate sexual maturity. Aureomycin was added to the diet, Purina Laboratory Chow, of the experimental animals in the ratio 100 ppm. The animals were fed ad libetum though a record was kept of the food that was consumed. Both the aureomycin and non-aureomycin animals were kept in activity wheeled and plain cages under controlled environmental conditions. The variable aureomycin and the type cage resulted in four groups of animals.

Activity was measured in terms of the actual number of turns of the activity wheel while weight gain was measured in grams. Food efficiency was the ratio of weight gain over food eaten. Activity and weight gain were analyzed by the analysis of variance of repetitive measures, the F test, while food efficiency was analyzed by the nonparametric Kruskal-Wallis one way analysis of variance by ranks and by the Sign test. Where it was required significant F's were further examined by the t test.

There was an increase in the activity of the animals receiving aureomycin which was shown to be significant by the F test. The significance arose in the third week. Activity itself was shown to increase significantly from week to week during this period. There was no significant interaction between aureomycin and weeks on activity.

The animals receiving aureomycin had a better weight gain than those animals not receiving aureomycin and again this difference was a significant one as shown by the results of the F test. The animals in the plain cages had a significantly better weight gain than the animals in the activity cages. The changes in weight from week to week

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during this developmental period were also significant. There was no significant interaction between aureomycin and activity, aureomycin and weeks and activity and weeks on weight gain. There was no significant interaction of the three variables aureomycin, activity and weeks on weight gain.

The results of the Kruskal-Wallis test and the Sign test showed that the animals receiving aureomycin had, in some weeks, a significantly better food efficiency than the animals not receiving aureomycin.

A significantly positive correlation was obtained in the first week only for the aureomycin animals in the activity cages, whereas a significant positive correlation was obtained in the second week only for the no aureomycin plain caged animals.

The results of the study showed that there was a significant and positive effect on activity due to the antibiotic in the diet and this met the hypothesis that aureomycin might affect the activity of the rat.

Microfilm $2.00; Xerox $6.00. 124 pages.

TREATMENT AND PROPHYLAXIS OF EXPERIMENTAL RENAL HYPERTENSION IN MONKEYS WITH RENINS AND ANTIRENINS

(L. C. Card No. Mic 59-1465)

Morton Howard Frank, Ph.D.
University of Illinois,
Chicago Professional Colleges, 1958

Experimental renal hypertension developed in eighteen monkeys after unilateral renal artery constriction at a 3:1 pulse ratio and became more marked after contralateral constriction or nephrectomy. Hypertension persisted in four out of five monkeys when the second kidney was left untouched. Chronic experimental renal hypertension in the monkey was treated with partial success in four experiments by daily injections of crude human renin. Antihypertensive responses regularly occurred when antirenin to human renin appeared in the plasma. However, the extent of the responses was not well correlated with the maximum titers of antirenin to human renin, which varied from 0.8 to 12 AU per ml. Comparable daily injections of crude human liver in two experiments were not therapeutically effective. Daily injections of semipurified hog renin from cortex in four monkeys were not therapeutically effective, although maximum plasma antirenin titers of 17 to 80 AU per ml. to hog renin were produced. Prophylaxis against the development of experimental renal hypertension with daily injections of crude human renin was partially successful in three preliminary experiments in which the plasma antirenin titer was greater than 0.5 AU per ml. to human renin and unsuccessful in two experiments in which the antirenin titer was below 0.5 AU per ml. Twelve attempts at prophylaxis with daily injections of crude and semipurified hog and dog renins were unsuccessful although antirenin titers as high as 27 AU per ml. to hog renin and 9 AU per ml. to dog renin were produced. The interfering effects of renal medulla which have been observed in dogs treated with hog renin (Wakerlin et al. J. Lab & Clin. Med. 41:708, 1953) were not observed. Passive administration of dog serum containing antirenin to human renin to seven renal hypertensive monkeys was followed by antihypertensive responses which were substantially more marked than in monkeys in which comparable antirenin titers developed over a period of daily injections of human renin. Decreases of blood pressure to normotension during passive therapy occurred in three of these when maximum antirenin titers of 0.7 to 3.2 AU per ml. to human renin were produced. Passive administration of normal dog serum or dog serum containing antirenin to hog renin to six monkeys was not followed by significant decreases in blood pressure. With both active and passive treatment, the minimum titers of antirenin to human renin required for minimal antihypertensive responses in the monkey were lower than the minimum effective titers of antirenin which have been observed by Wakerlin et al. (op. cit.) in dogs. Since monkey renin was found to be neutralized by antirenin to human renin, but not by antirenin to hog renin or dog renin, these results support the hypothesis that renin (or a closely related protein) plays a role in the pathogenesis of primate experimental renal hypertension. Attempts to alter the antigenicity of hog renin through chemical treatment so that the antibody produced by injections would neutralize human renin were not successful. Nephrotoxic side effects in the monkey did not result from daily injections of crude human renin or from passive administration of dog serum containing antirenin to human renin. Accordingly, similar experiments in the human, especially passive immunization, to determine the role of renin in essential hypertension are a practical possibility.

Microfilm $2.75; Xerox $9.60. 212 pages.

PERIPHERAL CIRCULATORY RESPONSES TO INDUCED HYPOTHERMIA IN DOG AND MAN

(L. C. Card No. Mic 58-7383)

Charles Albert Hamilton, M.D., Ph.D.
The University of Nebraska, 1958

A second listing. Please see abstract on Page 2919.

Microfilm $2.65; Xerox $9.20. 202 pages.

FACTORS MODIFYING THE ABSORPTION AND SYNTHESIS OF CHOLESTEROL

(L. C. Card No. Mic 59-1468)

Esko Karvinen, Ph.D.
University of Illinois,
Chicago Professional Colleges, 1958

Several parameters of the intestinal exchange of cholesterol in rats and normal human subjects and the biosynthesis and turnover of cholesterol in intact rats were studied.

The existence of a limited capacity for cholesterol absorption was demonstrated in the rat. The average capacity was estimated as 76 mg/day/250 gm rat. The percentage of absorption decreased gradually as the amount of dietary cholesterol was increased, being 61% for 96 mg, 47% for 192 mg and 32% for 288 mg of cholesterol intake per day.

The size of the endogenous intestinal cholesterol pool was estimated by three methods. The most reliable estimate was supplied by biliary fistula rats in which the amount of sterol in the feces and in the bile was determined after it was shown on the same rats that oral cholesterol-4-C^{14} was excreted completely in the feces. The entrance of endogenous sterol into the digestive tract was thus found to be 8.3 mg/100 gm body weight/day.

In man, a balanced low-fat diet was given to 16 young individuals. In each successive week 1, 3, 6 and 9 gm/day of cholesterol was added to the diet. The percentage of cholesterol absorption decreased with increasing intake, being 56% for 1 gram, 46% for 3 gram, 32% for 6 gram and 12% for 9 gram intake of cholesterol. The maximum average capacity of the human intestine to absorb dietary cholesterol was approximately 2 gm/day.

The fecal elimination of sterol on a lipid-free synthetic diet was determined in 11 subjects. It was found to be 421 mg/day on the average. The size of the endogenous intestinal cholesterol pool was calculated as 1400 mg/day on zero lipid intake. Of this pool 980 mg/day were reabsorbed into the body. Thus the total capacity of the human intestine to absorb cholesterol (dietary + endogenous) was estimated as 2.98 gm/day.

Experimental modifications of cholesterol absorption were accomplished by feeding mineral oil or palmitic and stearic acid which were found to augment fecal elimination of sterol in the rat. However, palmitic and stearic acid failed to interfere significantly with the absorption of cholesterol in human subjects.

Cholesteryl chloride and thiocholesterol which have been reported to block the utilization of cholesterol by insect embryos were found to be ineffective in interfering with cholesterol utilization in the rat.

The turnover time of liver cholesterol was determined in the rat on a lipid-free diet by administering carrier-free cholesterol-4-C^{14} orally and following its disappearance in the liver. The turnover time was thus found to be about 49 hours.

Studies on the incorporation of acetate-1-C^{14} into liver sterol in intact rats were carried out under different experimental conditions. It was found that squalene feeding led to an accumulation of sterol in the rat liver and prevented the incorporation of acetate-1-C^{14} into liver sterol. A squalene isomer was found which has the same properties and it is believed that the isomer is capable of participating in the biosynthesis of sterol. Farnesol and other squalene isomers did not have these properties and therefore are not considered as intermediates in sterol biosynthesis. Further modification of the squalene molecule failed to yield any compounds that were found to act either as intermediates or inhibitors of sterol biosynthesis.

Alpha-phenyl-n-butyric acid, a hypocholesterolemia inducing agent, was found not to depress sterol biosynthesis from acetate-1-C^{14} in the whole rat. The same was found with β-chlorocrotonic acid, a dimethylacrylic acid analog.

Ferric chloride which precipitates bile acids in vitro failed to interfere with the absorption of carrier or C^{14}-cholesterol and it did not accelerate significantly the turnover of liver cholesterol-4-C^{14}. However, ferric chloride feeding quadrupled the incorporation of acetate-1-C^{14} into liver sterol without increasing the incorporation into fatty acid. Microfilm $2.15; Xerox $7.60. 163 pages.

THE EXTRACTION AND ENDOCRINE ASSAY OF STEROID HORMONE METABOLITES IN HUMAN MALE FECES

(L. C. Card No. Mic 59-542)

Norman Meltzer, Ph.D.
University of Illinois, 1958

The excretion of biologically active steroid hormone metabolites in the feces of man (and also other animals) has not been a widely studied subject. Studies using steroids with radioactive components have shown that small amounts of testosterone and adrenocortical hormones and somewhat larger amounts of estrogen and progesterone metabolites are excreted in the feces of man. On the assumption that endogenous as well as exogenous steroid hormones are excreted in the feces, the experiments reported in this thesis were designed to investigate the endocrine activities of lipid extracts of the feces of men. These lipid extracts were divided into crude, neutral, acidic, and phenolic fractions (Dobriner et al., 1948, J. Biol. Chem. 172: 241-261.), the crude fraction being the water washed organic solvent extract. The extracts were dissolved in corn oil and equivalent amounts of each fraction were administered intraperitoneally to adrenalectomized, castrate, and intact rats. The extracts did not exhibit adrenocrotical or androgenic potencies at the dosages used. The crude and the acidic fractions elicited estrogenic responses, causing statistically significant increased uterine and seminal vesicle weight in castrate rats and causing inhibition of pituitary gonadotropins as evidenced by decreased seminal vesicle weights in intact rats. None of the fractions of the fecal lipid extracts caused consistent changes in the vaginal smears of either intact or castrate rats. The physiological significance of finding estrogenic materials in the acidic fraction of feces is discussed and the evidence concerning acidic metabolites of estrogen is reviewed.

In an attempt to gain insight about the physiological significance of steroid hormone metabolites that reach the gastrointestinal tract, activated charcoal was fed to rats (10% of feed) in the hope that the charcoal would adsorb the metabolites and thus prevent their absorption. The results of this experiment were equivocal, although there was some indication that the charcoal feeding caused delayed nipple formation and decreased uterine, seminal vesicle and prostate weights (when these weights were compared to organ weights of animals of the same age but on normal diets). The control animals for this experiment were fed 10% alphacellulose in the diet and there is reason to believe that the alphacellulose may have produced effects similar to those of the charcoal.

The literature concerning fecal and biliary excretion of steroid hormones is thoroughly reviewed.

Microfilm $2.00; Xerox $5.80. 119 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE INFLUENCE OF THE THYROID HORMONE ON BODY WATER COMPARTMENTS IN THE DOG

(L. C. Card No. Mic 59-547)

Corwin Morris Mokler, Ph.D.
University of Illinois, 1958

Many workers have observed that acclimatization to heat and cold is attended by regular variations in blood volume and possibly in extracellular fluid volume. Others have seen changes in these water compartments during thyroid disorders.

These experiments were conducted to study the relationship between the thyroid hormone and the maintenance of body water compartments in the dog. Five adult male dogs were used. Control values were obtained for oxygen consumption, plasma volume with T-1824, extracellular fluid volume with sodium thiosulfate, and total body water with deuterium oxide in these animals. They were given a course of oral desiccated thyroid (Armour) of 12 to 30 gr/dog/day for 30 to 33 days, and the measurements were repeated during and at the end of this treatment. Four of the dogs were allowed to recover for 41 to 47 days and the fifth animal was started immediately on gradually increasing oral doses of propylthiouracil. Again the measurements were made on the four recovering dogs, and then each was given 2 mg/day of Na 1-thyroxin I.V. for 5 or 6 days. Finally the above values were once more determined on each animal. The fifth dog received the anti-thyroid compound for 61 days, and determinations were made in duplicate during the last week of the experiment.

Although the results obtained were quite variable, the following conclusions may be drawn concerning the dogs used here:

1. Plasma volume will vary directly with metabolic rate in chronic thyroid feeding. Extracellular fluid volume is increased somewhat under these conditions, but is not as dependent on metabolic rate as plasma volume.
2. There is considerable individual variation in the response of dogs to orally administered desiccated thyroid.
3. When the metabolic rate is acutely altered with intravenous thyroxin, plasma volume does not vary directly with it. Extracellular fluid volume does not expand within the first five days of such treatment.
4. Evidence was found that propylthiouracil feeding causes a marked increase in plasma volume in the dog.
5. No evidence of a direct regulatory effect of the hormone on body water compartments was found in these dogs.
6. It is most probable that thyroid function and the regulation of body water compartments are related through an intermediate organ such as the adrenal gland or kidney during acclimatization and in thyroid disorders.

Questions bearing on this topic which require further investigation are outlined.

Microfilm $2.00; Xerox $4.80. 91 pages.

RETENTION AND EXCRETION OF RADIONUCLIDES OF THE ALKALI METALS BY FIVE MAMMALIAN SPECIES

(L. C. Card No. Mic 59-331)

Chester R. Richmond, Ph.D.
The University of New Mexico, 1958

The potential hazard of an internally-deposited radionuclide depends on its physical half-life, on the characteristics of the emitted radiation, and on its bodily assimilation, distribution, retention, and excretion. A knowledge of these parameters is required for the calculation of maximum permissible concentrations of radioisotopes in air, food, and water. Since biological data for humans are not often available, it is commonly necessary to use either data collected from experimental animals or values extrapolated from small animal data. These practices are subject to considerable criticism because of the variations among species.

The purpose of this study was to determine the retention and excretion patterns for several gamma-emitting radioisotopes of the alkali metals in several species of laboratory animals. From such data interspecific correlations could be attempted and possibly some common metabolic parameter established. If a good interspecies correlation were established, it would provide a better basis for an extrapolation from experimental animals to man. In any event, the results would provide much needed data on the retention and excretion of radioisotopes by man.

Large-volume liquid-scintillation counters were used to measure the biological half-time ($BT_{1/2}$), whole-body retention, and excretion of Na^{22}, K^{42}, Rb^{86}, Cs^{134}, and Cs^{137} in five species of animals. Mice, rats, monkeys, dogs, and men were given 0.1 to 1.0 μc amounts of the radionuclides by oral, intraperitoneal, or intravenous administration. Radioactivity in the excreta was measured at subsequent 24 hour intervals and the whole-body retention was followed by in vivo radioassay, where possible, until the retained body burden fell to 1.0 to 0.1 per cent of the administered dose.

The logarithms of the retention and excretion levels were plotted as functions of time after administration and standard first-order kinetics were applied to determine the $BT_{1/2}$ values and retention equations. The $BT_{1/2}$, as used in this report, is the time required for the whole-body activity to decrease by a factor of 2 due to biological loss.

These studies showed that the whole-body retention curves were best fitted by a single or multiple-component exponential function of the form

$$R = a_1 e^{-k_1 t} + a_2 e^{-k_2 t} + \ldots a_n e^{-k_n t}$$

where $a_1, a_2, \ldots a_n$ are the intercept constants; $k_1, k_2, \ldots k_n$ are the rate constants; and R is the whole-body retention at time t. The fractions of the total number of disintegrations attributable to each component of the retention curve were proportional to a_n/k_n. Values for the $BT_{1/2}$ of K^{42} in the mouse, rat, and dog were 1.3, 4.0, and 8.0 days, respectively. Respective values for Na^{22} in the mouse, rat, monkey, dog, and man were 1.7, 2.9, 7.5, 9.5, and 11.0 days; for Rb^{86}, 3.8, 8.6, 15.0, 20.0, and 80.0 days; and for Cs^{134} and Cs^{137}, 1.2, 6.5, 19.0, 25.0, and 110.0 days.

The $BT_{1/2}$ values for radiorubidium and radiocesium in man were greater by a factor of 6 than those presently

recommended by National and International Commissions on Radiological Protection. A calculation of the maximum permissible concentration of Cs^{137} in water, based on human retention data, was found to be a factor of 10 lower than presently recommended values.

Some variations among species occurred both in the major route of excretion and in the relative amounts lost by the different routes of excretion for a given radionuclide. The relationship

$$BT_{1/2} = k(SA)^b$$

where $BT_{1/2}$ is equal to the product of a constant and the body surface area raised to a constant power, serves as a first approximation for an interspecies correlation for alkali metal retention in the mouse, rat, monkey, dog, and man. Microfilm $2.00; Xerox $6.60. 140 pages.

INTERACTION OF VASOACTIVE FACTORS ON CIRCULATION IN ISOLATED SKELETAL MUSCLE

(L. C. Card No. Mic 59-1470)

Allen Asher Rovick, Ph.D.
University of Illinois,
Chicago Professional Colleges, 1958

The vascular influence of hydrogen ion and lactate concentrations and of epinephrine were studied in the isolated dog tongue. The tissues were perfused with a warmed, oxygenated, 1:1 mixture of fresh whole blood and heparinized, phosphate buffered Krebs-Ringer solution using a system which allowed the simultaneous recording of perfusion pressure, outflow rate and tissue weight. The perfusion pressure was maintained at a constant level throughout each experimental procedure. The hydrogen ion and lactate concentrations of the perfusion solution and the infusions of epinephrine were randomly determined for each experimental procedure, thereby permitting graphic and statistical separation of the individual influence of each material to be made.

The results of this study indicate that a decrease in pH or an increase in lactate concentration tend to independently dilate the blood vessels of this preparation. The sensitivity of the resistance response to altered pH, lactate concentration and administered epinephrine are dependent upon the resistance to flow at the time of application of the stimulus. The sensitivity of the vascular smooth muscle to altered pH tends to be greatest when the resistance is high and moderate when the resistance is low, under alkaline conditions; but is moderate when the resistance is low and least when the resistance is high under acid conditions. The sensitivity of the vascular response to alteration of lactate concentration is greatest when the resistance is low and the concentration change is low and least when the resistance is high, regardless of the magnitude of the concentration change. All alterations which produce a final concentration of 120 mg.% are associated with reduced vascular sensitivity.

The weight changes which accompany alterations in vascular dimensions are a measure of the net alteration of vascular and extra-vascular fluid content. The tissue weight tended to decrease exponentially with an increase in peripheral resistance except under conditions in which the resistance is high and the hydrogen ion concentration is altered or when the resistance is low and the lactate concentration is altered. These findings indicate that the resistance change is not always a good index of the total vascular response to a vasoactive agent. The dissociations between weight and resistance seen with pH and lactate have been interpreted to indicate an unequal effect of the stimulus on the arterial side of the circulation in comparison with the venous effects.

Microfilm $2.00; Xerox $4.20. 77 pages.

POLITICAL SCIENCE, GENERAL

REPRESENTATIVE GOVERNMENT IN JACKSONIAN POLITICAL THOUGHT

(L. C. Card No. Mic 59-481)

George Figures Brasington, Jr., Ph.D.
University of Illinois, 1958

The years of Andrew Jackson's Presidency, 1829-1837, were a time of momentous and tumultuous political activity in the United States. Jacksonian Democracy, the philosophy of government which typified the era, has attracted the attention of many biographers, historians, and political scientists. This thesis adds to previous studies an examination and analysis of the hitherto relatively unexplored subject of representative government in Jacksonian political thought.

In early nineteenth century America the expansion of the suffrage had kept pace with the westward extension of the frontier; the states entering the Union after 1817 had written no pecuniary qualifications into their constitutions. A further augmentation of the electorate has been accomplished through constitutional revision in the older states. The National Republicans, who were to become the Whigs, appealed to the newly enfranchised classes, particularly in the West, through a program of governmental assistance to corporations engaged in works of internal improvement. Under the vigorous leadership of President Jackson, the Democratic Republicans, who were later to be styled simply as Democrats, made a counter-appeal to the people for governmental simplicity and economy under the Jeffersonian maxim, "that government is best, which governs least." In the controversies which ensued, especially that over the recharter of the Bank of the United States, Jackson assailed the National Republicans as allies of the aristocratic portion of the business community and enemies of the common people. He endorsed the national party convention, which first had been employed for the election of 1832, as a valuable Democratic instrument to thwart the organized advocates of special privilege by affording direction and continuity to the political efforts of the multitude of ordinary persons who had rallied to his call.

In defending his veto of the Bank recharter bill, Jackson reproached the members of the congressional majority for misrepresenting the popular will. He revived the early Republican doctrine of instruction by requesting that the people and the state legislatures instruct their representatives and senators to sustain him. Because of the nature of the constituencies, the doctrine was virtually inconsequential as applied to the House of Representatives. In the Senate, however, the Jacksonians asserted that the instruction of a member by the legislature of his state imposed the duty of obedience; the only permissible alternative was resignation from office. The doctrine was repudiated by the Whig senators, who contended that its tendency was to subvert the conservative principles upon which the Senate was founded.

Jackson advanced the theory that the President "represented" the people of the United States in the executive branch of the government. He urged that the direct election of the Executive be provided for by constitutional amendment. In his exercise of the veto power, Jackson viewed himself as the guardian of the people against the unconstitutional and inexpedient measures of the Congress. Moreover, he declared that his duty to the people, especially in regard to the Bank, had been enhanced by a popular mandate in the presidential election of 1832. The Whigs disputed the thesis that the Executive was a popular representative. They decried Jackson's frequent employment of the veto power as contrary to constitutional intent and they repudiated his claim to a mandate from the people. The Jacksonians prevailed in these congressional-presidential controversies with the Whigs, but it was the expositions of both that made the Jacksonian era a memorable period in the history of American political thought.

Microfilm $2.00; Xerox $6.20. 129 pages.

CHARTER REVIEWED. THE NEW JERSEY CONSTITUTION 1947-1957.

(L. C. Card No. Mic 58-7836)

Robert G. Cutler, Ph.D.
Princeton University, 1958

This study deals with the first ten years of the 1947 New Jersey Constitution. The previous constitution, that of 1844, was characterized by its many inflexibilities, complexities, and anachronisms. The basic problem of the study was to determine the extent to which the new charter a) did away with these characteristics, b) satisfied the claims of its proponents, and c) provided for a government adequate to meet the demands of a growing modern state.

This investigation of contemporary New Jersey constitutional problems was aided through interviews with scholars, knowledgable citizens, influential members of the 1947 Constitutional Convention, and present and former state officials. Questions were asked about the operation of various constitutional provisions, suspected deficiencies in theory or practice, and probable future developments.

The analysis of the constitution and its implementation revealed that:

1. the constitution itself is on the whole a concise treatment of fundamentals.

2. the anti-discrimination provision of the Bill of Rights has significantly increased the practical possession of certain rights by minority groups.

3. a better balance has been established between the three branches of government, but the continuation of a constitutionally unrepresentative

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legislature may mean frequent party splits between executive and legislature.

4. alleged unconstitutional usurpations or actions by the executive and the judiciary are largely unfounded.
5. except for the limitations on responsible, representative action in the senate (due to its caucus controlled, small county dominated structure), no important constitutional barriers inhibit the performance of legislative functions. Organizationally and administratively the legislature as a whole is comparatively well equipped to meet its responsibilities.
6. the governor has acquired strong, effective control over the direction of the executive branch.
7. the administrative reorganization of the executive branch has been somewhat disappointing. The concept of reorganization as a continuing process seems not to have taken root.
8. the reorganization of the judiciary was highly successful and was the most spectacular result of constitutional revision.
9. taxation remains the state's number one problem, but the main difficulty appears to be legislative rather than constitutional or administrative in nature.
10. the new amendment clause seems workable enough, but the lack of the initiative or of periodic constitutional revision places practical limits on future constitutional reform, particularly of the legislature.
11. increased public participation and education in public affairs in New Jersey, the stimulation and encouragement of reform groups elsewhere, and the suggestion of practical solutions to problems found in other jurisdictions can be attributed to constitutional reform in New Jersey.

Given energetic leadership, the governmental framework provided by the 1947 New Jersey Constitution should prove sufficiently flexible to meet the needs of state government for the foreseeable future. Constitutional barriers to effective executive and judicial administration were swept away by the new charter. The legislature was not radically changed, but the establishment of a more effective balance between it and the other branches may partially offset some continuing shortcomings. The reformers have been disappointed in the results of administrative reorganization of the executive branch, but the revitalization of the judiciary has exceeded most expectations. All things considered, the accomplishments of the 1947 New Jersey Constitutional Convention have brought about an amazing amount of change and reform.

Microfilm $2.75; Xerox $12.00. 212 pages.

JAMES K. POLK AND THE AMERICAN PRESIDENCY

(L. C. Card No. Mic 58-3110)

Charles Allan McCoy, Ph.D.
Boston University Graduate School, 1958

Major Professor: Lashley G. Harvey

The Democratic victory in 1844 brought to the office of President of the United States a man who was determined to establish for that position the prerogatives of an independent, equal branch of the government. He accepted without question or doubt all the vast responsibility which the office placed upon his shoulders; he was never willing to say that a Presidential responsibility for a given task rested with Congress, with a member of his cabinet, or with the military. Rather by all his words and deeds he said the responsibility rested with the President.

This dissertation has as its thesis a twofold proposition: first, that the Polk administration institutionalized those changes in the American Presidency which have become associated with the Jacksonian-type executive; and, second, as a coordinate thesis, that President Polk in his own right made some significant contributions to the presidency.

In reference to the first proposition it has been demonstrated that Polk, in a more direct manner even than Jackson, advocated and acted upon a theory that the executive is directly responsible to the people. Furthermore, Polk controlled the subordinate executive officers of the government with a degree of consistency never equaled by Jackson. Polk as the driving power behind "manifest destiny" represented the great force of his time, as Jackson had been in a similar way the symbol of the growing demands for popular democracy during his administration. Finally, as a political leader, Polk attempted to follow closely in Jackson's pattern, but already the times were demanding a new type of leadership, a dynamic personal leadership of the people, a role which Polk was unable to fill.

To demonstrate the second proposition, it is necessary to refer again to Polk's control over the subordinate officials of the executive branch of the government, for in this regard Polk's supervision was so much more pervasive than Jackson's that it really represents a difference in kind rather than degree. Polk established the precedent that as a matter of institutionalized routine it was the right and the responsibility of the President to control and supervise all actions of the executive branch of the government. This was carried to the extent of instituting for the first time a truly executive budget, which reflected the President's choice of goals and administrative objectives. Polk's other major contribution to Presidential development was his domination in a similar fashion of the military. He resolved the constitutional doubt which Madison's inept exercise of the role of commander-in-chief had raised regarding that important Presidential function by demonstrating conclusively in time of war that a civilian without previous military experience could effectively exercise the powers of military command which the Constitution had placed in his hands.

The material in this dissertation is presented in terms of the traditional analysis of Presidential authority and operations. As Louis Brownlow reminds us, no cataloging

of the various roles that the President plays would satisfy all students of the Presidency. Nevertheless, for purposes of analysis, it seems essential to make such a classification so that the tools of the political scientist can best be brought to bear on the subject. Therefore, chronological order has been sacrificed for analytical clarity, and the dissertation is organized around such themes as Polk's concept of the Presidency and the President as commander-in-chief, chief of foreign affairs, chief legislator, and party chief.

In addition to the contemporary works on the Presidency and historical studies of the period the dissertation makes extensive use of Polk's diaries and his personal papers which have been collected at the Library of Congress. Microfilm $3.75; Xerox $12.60. 289 pages.

TOWARD A THEORY OF LEGISLATIVE BEHAVIOR: THE WISCONSIN STATE ASSEMBLYMEN AS ACTORS IN A LEGISLATIVE SYSTEM

(L. C. Card No. Mic 59-1177)

Samuel Charles Patterson, Ph.D.
The University of Wisconsin, 1959

Supervisor: Associate Professor Ralph K. Huitt

Statement of the Problem. This thesis approached both problems of theory and research in legislative behavior. A tentative theory of legislative behavior was constructed, based principally on system and role theory. The theory was designed to function as a paradigm for subsequent empirical research in an area where no adequate behavioral theory had heretofore been developed.

The empirical research was conducted with members of the 1957 session of the Wisconsin State Assembly, the lower house of the state legislature. The principal conceptual tools were those of position, role, and function. The empirical study was based on an exploratory design, formulated to discover relationships and develop hypotheses about the roles played by legislative actors in the Assembly.

The role of legislators was conceptualized as the dependent variable of the research, and was related to a variety of other variables such as social and political background, political affiliation, nature of the constituency, ideological orientation, party deviance, political aspiration, and perception of district-party conflict.

Methods of Research. The principal method used was that of an interview schedule. Over 80 percent of the members of the 1957 session were interviewed using a structured questionnaire, either personally or by mail. In addition, several independent indices were employed, and were related to interview results. These were the indices of liberalism-conservatism and party deviance developed from recorded roll call votes; the index of election margins developed from the 1956 election results and used to summarize the nature of the political system in legislative districts; and the rural-urban index developed from the 1950 census and used to summarize the ecological nature of the districts.

The principal statistical test employed was the chi square (x^2). Data were presented both in tabular and graphic forms.

Results. The study made possible, by means of interview coding and analysis, the identification of key roles in the Assembly. Special emphasis was placed on the legislators' perception of his own role and his expectations of the roles of speaker, committee chairmen, and party floor leaders. Significant differences between party members were tabulated. Special analysis was given to the roles of leaders, experts, friends, new members, and deviants. Three cases of deviation were analyzed: the talker, the moocher, and the maverick.

Statistical data were supported by extracts from interviews, and such quotations made possible some qualitative analysis beyond the specific statistical analysis. Special attention was given to the character of the norms of the legislative group and the way in which these norms are organized into roles.

Conclusions. The empirical research permitted evaluation of the original paradigm, and yielded a series of hypotheses. The following statements summarize the principal findings of the empirical study:

1. There are significant sociological and political differences between Republicans and Democrats in the Wisconsin Assembly.
2. The most salient role perception for most Assemblymen is that of literally representing their own districts.
3. Actors who play leader roles tend to be the ideological prototypes of their party---at the extreme of their party ideologically. Also, leaders tend to be more loyal to party- or group-defined decisions than non-leaders.
4. The differences in the social and political backgrounds of members tend to be ameliorated by a definable informal sub-structure in the legislative group, identified by an analysis of the role of friend.
5. New members tend to be differentiated from old-timers in the Assembly principally by virtue of differences in political aspiration.
6. Deviant roles in the legislative group tend to develop as a function of violations of widely-shared legislative norms. Microfilm $4.80; Xerox $16.00. 375 pages.

LIBYA: A STUDY OF NATIONAL AND INTERNATIONAL FACTORS LEADING TO ITS UNITY AND INDEPENDENCE

(L. C. Card No. Mic 58-7050)

Najmuddine Rifai, Ph.D.
Columbia University, 1958

Libya's evolution towards its present status was due both to internal as well as to external factors. After the Arab invasions of the seventh and the eleventh centuries, the country acquired a homogeneity of national characteristics, which was to militate in favour of its political coherence, notwithstanding the obstacles of geography.

The Great Sirte which up to the Italian occupation had separated Cyrenaica from Tripolitania and the vast span of desert between these two regions receded in modern times, as a dividing influence, before the stronger unifying force of nationalism. Libyan nationalism, however, was not the product of simply a common language and tradition between Cyrenaica and Tripolitania. As a militant force, it was due largely to the people's reaction to the foreign onslaught on their freedom and their domain.

In opposing the colonial rule of Italy, the Libyans found a ready national organization in the Sanusi movement. This religious fraternity became the standard around which most of the patriotic forces which fought the Italians rallied. It even assumed the functions of government after the withdrawal of Turkey from the scene as a result of the Peace Treaty of Ouchy, which the Turks were forced to sign with Italy.

National resistance after the withdrawal of Turkey from Libya passed through different episodes and experienced many vicissitudes, but it remained guided and inspired to a large extent by Sanusi leadership until it was finally suppressed in 1932, thanks to Italy's overwhelming might and the severe measures to which Graziani resorted at the time. Italy's success in pacifying Libya, however, was unavailing when it came to extirpating the national spirit of its people. Their desire to free their country, coupled with the harsh Italian rule, left the fire of resistance smoldering among those who continued to live inside Libya, and drove those who had emigrated to neighbouring Arab countries into all sorts of activities to foster the cause of freedom for their homeland.

The Libyan emigrés, under the leadership of Sayyed Idris al-Sanusi, were afforded a great opportunity to renew the struggle for the liberation of their country when the Second World War broke out. Without delay, they approached the British High Command in Egypt to offer their assistance should Italy enter the arena of war. When this took place, thousands of Libyans volunteered in the British Army, which in addition was given all sorts of aid by the Libyan population as it advanced into Libyan territory. In recognition for this war effort, Mr. Eden, who was then Foreign Secretary, made the following declaration in a speech before the House of Commons in January, 1942: "His Majesty's Government," he said, " are determined that, at the end of the war, the Senussis of Cyrenaica will in no circumstances again fall under Italian domination."

This promise was to engender internal and external difficulties when the fate of Libya came up for decision at the end of the war. Libya emerged from the conflict divided into three zones of occupation, with Cyrenaica and Tripolitania administered separately by the United Kingdom, and the Fezzan by France. Each of these zones was the object of conflicting foreign interests which proved irreconcilable. Thus after two years of wrangling, the Council of Foreign Ministers failed to reach an agreement over the future of Libya. All solutions which were proposed during this period contained elements which were unacceptable to one or more of the Big Powers, and rarely met with the unanimous approval of the Libyans.

Under such circumstances, the problem was referred for decision to the United Nations. Although this organization was greatly influenced by the western Big Powers, which had in the meantime agreed to maintain the division of Libya, placing Cyrenaica under British, Tripolitania under Italian, and the Fezzan under French Trusteeships, it proved unable to overcome the opposition of the Soviet, Asian and African blocs, which strove to insure Libya's independence.

Ultimately on November 21, 1949, the General Assembly passed a resolution declaring Libya a unified and independent State and specifying that this should become effective not later than January 1, 1952. A United Nations Commissioner was appointed to implement that resolution. His efforts were crowned with success when King Idris I proclaimed to the world on December 24, 1951, the independence of the United Kingdom of Libya.

Microfilm $5.05; Xerox $17.20. 396 pages.

THE ILLINOIS COURT OF CLAIMS: A STUDY OF STATE LIABILITY

(L. C. Card No. Mic 59-583)

Frederick Charles Spiegel, Ph.D.
University of Illinois, 1958

It is a well established principle of Anglo-American jurisprudence that a soveriegn state cannot be sued without its consent. While aggrieved citizens have always been able to petition the legislature for redress of their grievances at the hands of the government, such a remedy has generally been found inadequate. Dissatisfaction with the principle of governmental immunity from suit and with legislative settlement of claims has prompted the Federal Government and certain state governments to make provision for hearing and determining the claims of their citizens by judicial or administrative agencies. Those states desiring to provide a systematic procedure for claims settlement have developed quite diverse methods in achieving that objective. Out of this diversity appear four basic methods of claims adjustment. Fourteen states have enacted general consent statutes whereby claims against the state may be heard by the same courts and according to the same rules of procedure as are those against individual defendants. Claims boards or commissions made up principally of persons serving in an ex-officio capacity have been established in sixteen states, such boards or commissions having varying degrees of jurisdiction. Two states, New York and Michigan, have established judicial courts of claims, these being courts of record whose decisions may be appealed to higher judicial tribunals. Illinois alone uses an administrative court of claims.

The bulk of this study deals with the Illinois court of claims, an administrative agency following judicial procedures, which was established in 1903. A special type of agency is necessary in Illinois since the constitution of 1870 provides that the state shall not be suable in courts of law or equity. Awards granted by the court of claims depend for their payment upon legislative appropriation; but it is the declared policy of the general assembly that no appropriation will be made for claims within the court's jurisdiction unless an award has been made by the court.

The jurisdiction of the court of claims, at first narrow, has been extended and enlarged through the years to the point where at present it includes not only contract claims but also personal injury and other tort claims based on considerations of law or equity. In tort cases, the jurisdiction is limited to those instances in which the claimant would be entitled to redress if the state were suable in regular courts.

Until 1945 some doubt existed as expressed in opinions of the court of claims, as to the extent of liability that had been assumed by the state for the negligent acts of its agents and employees. However, the Court of Claims Act of 1945, which is the basic legislation presently in effect, makes it the declared and explicit policy of the state that

the defense of non-liability for the negligence of its officers, agents, and employees in the course of their employment is not applicable to claims falling within the jurisdiction of the court. Thus Illinois occupies a place among the leaders in the movement for greater assumption of liability on the part of the state.

This study concludes that, while Illinois has made considerable progress toward the establishment of fair and equitable procedures in the settlement of claims, two innovations would result in more satisfactory claims adjustment. First, statutory provision authorizing administrative departments to settle small claims would relieve the existing situation wherein costs of litigation consume a major portion of small awards. Second, amendment of the constitution to permit the establishment of a judicial court of claims would make it possible for decisions of that court to be reviewed by higher judicial authority.

Microfilm $3.45; Xerox $11.80. 267 pages.

THE ADOPTION OF THE TWENTY-SECOND AMENDMENT

(L. C. Card No. Mic 59-785)

Frederick Donald Zucker, Ph.D.
The Pennsylvania State University, 1958

The Twenty-second Amendment, limiting the tenure of the President to two elected terms, or a maximum of ten years should a Vice President succeed to the presidency, became part of the Constitution on February 27, 1951. Upon its ratification, what had generally been interpreted as a sacrosanct constitutional usage before Franklin D. Roosevelt's third term victory in 1940 was transformed into an absolute legal restriction. The purpose of this study was to determine why and how that amendment was adopted by isolating and examing the influences motivating the members of Congress and the state legislatures, and the techniques they employed to achieve their goals.

In the context of the American separation of powers system, the leaders of the Republican party in Congress, with the support of their partisans and the more conservative southern Democrats, sought to increase the power of the congressional leadership at the expense of the President. The underlying assumption of the proponents of the amendment was that an incumbent who could not run again after his second election would be in a considerably weaker position in his relations with Congress.

From 1937 to 1944, the efforts of these men were confined to attempts to prevent the reelection of President Roosevelt who embodied the type of leader to which they objected, and who also kept them in the minority by winning majorities at the polls. During this period, the opponents of a strong presidency invoked the two-term tradition and supported anti-third term resolutions, whether merely expressions of congressional sentiment or concrete proposals for an amendment. But after Roosevelt's death in April, 1945, they no longer sought public support for their amendment.

The November, 1946, election returned Republican majorities to both houses of Congress where, with considerable southern support, the G.O.P. passed the 22nd Amendment-to-be quickly and quietly; quickly so the state legislatures in session could act on it; and quietly to avoid awakening any strong popular opposition that might have resulted from widespread publicity. In the interest of speed and silence, no public hearings were held. The press stimulated little discussion, and no interest groups muddied the political waters so as to draw attention to the issue. The public was engrossed in the more dramatic measures coming before Congress. President Harry Truman remained completely aloof and most members of Congress were themselves only midly interested. In the absence of these potential pressures, the leaders experienced little difficulty in mobilizing the support of their partisans. In both houses the Republicans voted unanimously for the amendment. Except for 47 Democrats in the House and 13 in the Senate, opposition cohesion was also high.

Between 1947 and 1951, every Republican state legislature and all but four of the nonsouthern Democratic legislatures followed the lead of their congressional counterparts. In the nonsouthern state assemblies, as in Congress, no constituent or interest group pressures were discernible. Press coverage of state legislative activity was likewise poor.

In the South, after the Truman civil rights program was announced, the conservative blocs in the legislatures of every state of the old Confederacy succeeded in having the proposed amendment ratified. Their purposes were to express disapproval for Harry Truman and his program, to discourage any renomination ideas he may have been entertaining for 1952, and to weaken the potentiality of the presidency to initiate and execute future civil rights campaigns.

The progress of the proposed amendment through Congress and the state legislatures is an example of legislative combat wherein the fighters were neither organized pressure groups nor administrative agencies. It does not fit any of the classic patterns of interest group struggle. Here the party leaders and a handful of other interested legislators had the field to themselves because they were operating in an atmosphere of executive and legislative disinterest and neutralized or uninformed public opinion. Here is the case history of a purely political measure, one which began and ended among party leaders, and in the interest of party leaders, but one which could have grave consequences for the entire nation.

Microfilm $3.35; Xerox $11.40. 259 pages.

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

THE LEGAL IMPLICATIONS OF THE REPATRIATION OF WAR PRISONERS IN RELATION TO THE KOREAN ARMISTICE AND IN VIEW OF THE DIVISION OF KOREA

(L. C. Card No. Mic 59-885)

George K. Alapatt, Ph.D.
St. Louis University, 1958

With the end of World War II, Korea was partitioned on the 38th parallel into North and South, the Russian troops occupying the North and the American Forces the South. The tension between the two parts of the country steadily grew and it resulted in open aggression in June 1950. In spite of the early efforts made to end the war, the repatriation of the prisoners of war happened to be the last obstacle that blocked the final signing of an armistice agreement in Korea. A Neutral Nations' Repatriation Commission consisting of India, as chairman, and Sweden, Switzerland, Czechoslovakia and Poland as members was created in order to take custody of the prisoners and to effect their repatriation.

This dissertation is primarily concerned with the work of the Commission in relation to its legal impact on the problem of the repatriation of prisoners of war. Although questions relating to the repatriation of prisoners had arisen before the Korean conflict, never in the history of any major war had such a situation developed as the one in Korea in which a large number of prisoners expressed their unwillingness to be repatriated to the countries from where they originally came. Therefore, the existing rules of international law laid down in International Agreements were often inadequate to solve the numerous issues raised by the problem of prisoners in the Korean War. For instance, the Hague Conventions of 1899 and 1907 and the Geneva Conventions of 1929 and 1949 dealt mainly with the humane treatment of the prisoners and their speedy repatriation after the cessation of hostilities.

The procedure followed in this study includes: 1. An Introduction that deals briefly with questions of the general background of Korea; 2. A First Part that takes the Korean conflict to the international front, discussing the main highlights of its history from World War II to the outbreak of hostilities in 1950; 3. A Second Part which is chiefly devoted to the dispute related to the issue of forcible or voluntary repatriation of prisoners of war; 4. A Final Part that presents the conclusions.

This dissertation has attempted to prove that the Commission has made a substantial contribution to the development of international law and practice by setting down useful precedents for future guidance, particularily in reference to questions like the Status of a Neutral or 'Neutralist' Nation within the United Nations, the Guarantee of Basic Human Rights, the Value and Scope of Historic Interpretation of an International Agreement, the Principle of Voluntary Repatriation of Prisoners of War as opposed to total or forceful exchange and the Conduct of Criminal Proceedings against the Prisoners of War during the Period of their Detention.

Microfilm $3.05; Xerox $10.40. 235 pages.

THE UNITED NATIONS SECRETARIAT AT WORK

(L. C. Card No. Mic 59-1433)

Thomas Alva Bartlett, Ph.D.
Stanford University, 1959

Supervisor: H. Watkins

The Secretariat of the United Nations provides a wide range of services to the United Nations system. The objective of this study is to describe and analyze the work of the Secretariat at the end of its first decade. The study is based on a large number of interviews with Secretariat members conducted during almost a year spent at the Secretariat as well as on documentary materials.

The Secretariat's contribution to the United Nations must be understood on two levels: the day-to-day tasks of the Secretariat in each of the several fields in which it operates and the broad functions it performs as an institution in the United Nations system. This study consecutively deals with these two levels.

For reasons chiefly related to the subject of its work, the Political Department of the Secretariat at the end of the first decade was limited to routine service tasks in contrast to the personal political role of the Secretary-General. In economic and social affairs, including matters of human rights and the work of the Statistical Office, the Secretariat carried out varied and significant tasks. Growing emphasis on direct assistance to governments seeking to speed programs of economic and social development provided a unifying and stimulating policy.

The Secretariat was deeply involved in all three aspects of the Trusteeship System, annual reports, visiting mission and petitions. It was also given the task of preparing information transmitted to the Secretary-General under Article 73e for discussion by the Committee on Information from Non-Self-Governing Territories.

The Department of Public Information assisted newsgatherers from all media to "cover" the United Nations. In addition it produced and distributed films, pamphlets, books, etc. The Office of the Legal Counselor provided legal counseling for United Nations organs, serviced meetings of United Nations organs which deal with the substance of international law and carried out the Charter obligations given the Secretary-General for the registration and publication of treaties. The Secretariat also provided general conference services consisting of meeting facilities, including staff, documentation services, records services and publicity.

In doing its work in specific fields the Secretariat contributed four broad functions to the United Nations system. The first of these was executive services which consisted of basically routine or non-political services for which the Secretariat was given wide authority. The second was the discretionary role of the Secretariat. This consisted both of the choices of means and degree made by the Secretariat in carrying out mandates from United Nations bodies and of the suggestions it made concerning policies still being formulated.

The third broad function of the Secretariat was coordination. This involved close coordination of the main organs and their sub-groups meeting at Headquarters and Geneva, a feeble exchange of information among the Charter organs and the Specialized Agencies of the United

Nations system and the attempt to relate when appropriate a long list of non-governmental organizations to the work of the United Nations. The fourth broad function was direct assistance to governments requesting help to accelerate economic and social development. Direct assistance consisted of Technical Assistance in its various aspects, certain informational studies and personal activities (missions abroad, discussions at headquarters, correspondence, etc.) by Secretariat officials.

The study ends with a brief summary of the emphasis in each division of the Secretariat's work, and possible trends of future development.

Microfilm $5.50; Xerox $19.40. 431 pages.

THE ROLE OF THE M.R.P. IN FRENCH FOREIGN POLICY, 1944-1954

(L. C. Card No. Mic 58-3092)

Russell Beckett Capelle, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor Murray Levin

The purpose of the writer is to demonstrate that the principal handicaps to the success of the Mouvement Républicain Populaire in its foreign policy objectives, while in control of the French foreign ministry from 1944 to 1954, were the contradictions to be found within its political philosophy and among party personalities. The M.R.P. sought to be too much to too many. Being a distinctively regional party and lacking adequate contact with industry, the bureaucracy and the press, it was something less than a "movement". Being strongly centralized, it did not reflect in its structure the pluralism that was part of M.R.P. political philosophy. Such contradictions as these and others to be mentioned presently led to a striking contrast between words and deeds of party leaders, and between a professed preoccupation with foreign policy and an actual preoccupation with domestic policy.

During ten years of continuous control of the foreign ministry, European integration was the key foreign policy of the M.R.P. After initial success in the creation of the European Coal and Steel Community, the party's task was complicated by uncertainty within the party as to what type of "Europe" should be built. Moreover the growing social Catholicism of this "Catholic Party" made it suspect of promoting a clerical "black Europe". Finally, the plans for supranational functional institutions, although partly in accord with M.R.P. pluralism, were opposed by strong political and economic pressure groups and were incompatible with the French concept of sovereignty.

The M.R.P. also believed that France as mediator should try to heal the East-West split. This led the party into a dilemma because of its philosophical affinity with neutralism but its actual support for American policy in Europe. Moreover, although the party was in opposition to a "crusade" against communism, the overwhelming concern of the M.R.P. for the French national interest led it to oppose negotiation and concentrate on resistance in the Indo-China war. Similarly M.R.P. devotion to supranational schemes of European integration came into conflict with its nationalistic policy toward North Africa, where it sought to preserve centralization of control in the "métropole". Although party leaders opposed the Mendès-France thesis that "to govern is to choose" and insisted on a consistent world policy, in their deeds they were forced to make choices inconsistent with party political philosophy.

The M.R.P. may have accepted various compromises in order to preserve the continuity of its program of European integration, but party leaders preferred conciliation to compromise. They played a waiting game, and it is striking how well the party held together during this difficult period. Nonetheless, the M.R.P. was troubled by internal disagreements on methods of achieving objectives, by inexperience of some leaders in political skills, by contradictory statements, and by significant fluctuation in enthusiasm for objectives. Most important, perhaps, were a disregard for the sensibilities of the French parliament and a lack of elasticity of approach to objectives.

Despite these many contradictions and weaknesses, the M.R.P. succeeded in preserving the continuity of French foreign policy and paved the way for the European common market and "Euratom". It played a part, also, in making foreign policy an increasingly important factor in the survival of French Governments. However, being tied as it was to the nineteenth century through its church connections, the M.R.P. was doomed to failure in its attempt singlehandedly to lead such a secular and national state as France into an integrated European community.

Microfilm $3.95; Xerox $13.40. 306 pages.

BENELUX: AN EXPERIMENT IN THE COMPATIBILITY OF SOVEREIGNTY WITH INTERNATIONAL COOPERATION

(L. C. Card No. Mic 59-1258)

James Elstone Dow, Ph.D.
University of Minnesota, 1958

The thesis concerns a political problem in the light of its origins and of its present status and indicates the possibility of a future solution. The physical setting of the problem is an area of geographic unity within the close confines of which over twenty million people live. The distances within the area are not great, and physical communication among all sectors of the area is generally unobstructed. Economically and strategically the Low Countries form a common frontier for three vastly larger and more powerful national and geographic units. For this reason the area under consideration is denied the pleasure of living unto itself and is, on the contrary, now the victim, now the beneficiary of cross currents of interests and cultures. Within itself the area reflects the diversity of the various neighboring cultures, but its interests are largely uniform and peculiar to itself.

The peoples of the Low Countries have not considered themselves, nor have they been considered by others as one people. Originally divided into seventeen distinct groups, the peoples of the area gradually arranged themselves or were arranged by external forces into three separate and distinct national units, each independently sovereign. History has provided each of the nations with a multitude of reasons for its separate and independent

existence, and each nation is fully aware of its history. Each of the nations is jealous of its autonomy and individual identity, and none is prepared to allow an outside force the right to pronounce the final word regarding the future of its national independence and welfare.

Events of the past few decades have made each of the nations of the Low Countries aware of its comparative weakness, especially in the economic sphere. Hesitant attempts at cooperation have been made in order to find in unity the strength no one can possess alone. To the extent that the attempts have been successful one has applied the unitary name, Benelux, to the area. The problem is the realization of the unity which this name in its fullest sense implies.

A political superstructure has been suggested as the necessary but lacking element in the cooperative effort which is Benelux. At present the Benelux Union remains a free association of sovereign nations without the slightest degree of realization of a political superstructure. Without a political superstructure one may well expect a continuation of the existing kind and degree of cooperation. The Benelux Union has achieved limited but praiseworthy results, and one may expect that the achievements will be protected and possibly extended through the cooperative effort. But such expectations are only valid if the present favorable circumstances within which Benelux has grown will continue. These circumstances include the apparent need for and the popular desire for economic cooperation, the mutual good will and forebearance of the member nations in their relations with one another, the beneficent attitude of neighboring States, and the absence of economic crisis in any one sector of the Union. If, on the contrary, a political superstructure were achieved for the Benelux Union the prospects for continued mutual effort and mutual benefits would increase immeasurably. The unity of Benelux would, in fact, be a reality.

Microfilm $2.70; Xerox $9.40. 207 pages.

THE UNITED STATES AND NON-SELF-GOVERNING AREAS: A STUDY OF THE RELATIONSHIP OF THE UNITED STATES AND THE UNITED NATIONS UNDER CHAPTER XI OF THE CHARTER

(L. C. Card No. Mic 59-1513)

Jorge Morales-Yordan, Ph.D.
The American University, 1959

The present study has as its main purpose the evaluation of the policies of the United States regarding Non-Self-Governing Territories from 1944 to 1957. It is an analysis of the record of the war-time conferences at Dumbarton Oaks and Yalta, the San Francisco Conference and the records of the United Nations, in an effort to determine the positions assumed by the United States in problems relating to colonialism. The United States has been faced by serious dilemmas in colonial issues. Its major Allies, including the United Kingdom, France and other members of the North Atlantic Treaty Organization, have been identified traditionally as colonial nations. They expect the support of the United States and in many cases such support is deemed vital to the national prestige. Many of the newly independent nations of Asia and Africa have strong views on the matter. To these nations the solution of the colonial question can be but one: the complete elimination of colonialism in whatever form presented. Their recent experiences as colonial possessions of the European countries, in many cases their bitter struggles for independence, make them feel that all dependent territories should be made self-governing, if not completely independent. To the United States this has represented a serious dilemma: to support the colonial nations may mean loss of the anti-colonial bloc and vice-versa. In addition, in order to support the anti-colonial bloc it might be necessary to change the political status of the American territories and possessions.

In order to provide suitable solutions to these problems, this dissertation attempts to give a legislative history of Chapter XI of the Charter: A Declaration Regarding Non-Self-Governing Territories. It analyzes the operation of the Chapter and the four basic problems arising under it: (1) the competence of the General Assembly to determine whether or not a territory has achieved self-government; (2) the factors to be used in such a determination; (3) the necessity for an administering Power to submit political information on its territories; and (4) the question of the establishment of a special organ of the United Nations to consider the information submitted and make necessary recommendations. The position of the United States as to each question is analyzed.

Particular attention has been paid to the various cases which the General Assembly has had to consider to determine if territories are self-governing or not: Indonesia, Puerto Rico, Greenland, the Netherlands Antilles and Surinam and the Federation of Malaya. The case of Puerto Rico is studied in detail since this is the only territory of the United States which has been identified as self-governing by the General Assembly.

A chapter of the dissertation deals with the administration of the territories and possessions of the United States. Various problems of administration are pointed out and the possibilities of statehood or self-government for the territories are evaluated. The study suggests that collaboration with and support of anti-colonial nations can be greatly increased if these American Territories were to be made, either states of the Union, in the case of Hawaii and Alaska, or self-governing commonwealths, when feasible, in the case of the Virgin Islands, Guam and American Samoa.

After analyzing the responsibilities of the United States under Chapter XI of the Charter, the writer concludes that the United States has tried to follow a middle course in colonial questions but that this course has not been a rigid one. The United States has tried to avoid siding completely with the colonial or anti-colonial nations, so that neither maybe alienated, and so that a larger measure of international cooperation may be achieved when both sides find solutions which they can accept as compromises. The study further concludes that the dilemmas faced by the United States in colonial matters may possibly be solved by granting self-government or statehood to the American Territories. This would terminate the primary responsibility of the United States under Chapter XI of the Charter and would allow this country to follow a stronger anti-colonial policy. This course would probably result in a larger measure of support of American policies by the Asian-African nations and would eliminate any basis for Soviet and Asian-African charges that the United States is just one more colonial Power.

Microfilm $3.60; Xerox $12.20. 279 pages.

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

ADMINISTRATIVE ORGANIZATION AS A SOCIAL SYSTEM: AN INTRODUCTION TO THEORIES OF ORGANIZATION

(L. C. Card No. Mic 59-529)

Charles Adrian Joiner, Ph.D.
University of Illinois, 1958

Administrative organizations are viewed as cooperative and adaptive social systems which include both operating members and clientele members. Analysis of such organizations relies upon the development of organizational theory. However, organizational theory is incomplete unless it also incorporates a theory of politics. Administrative organizations operate in a political milieu in which their structural arrangements and functional activities must be adapted to internal and external tensions. If these adaptations are efficient, the organization will survive and thrive. Efficient adaptations are consequents of the operations of an organization's homeostasis control mechanisms. If these homeostasis mechanisms operate efficiently, a favorable input-conversion-output process will occur, i.e., organizational equilibrium will be attained and maintained. This equilibrium is dynamic, involving equifinality, and is solely a trait of open systems. It is an equilibrium process. Organizational equilibrium depends upon a favorable economy of incentives and an efficient administrative process. The administrative process is a decisional process involving defining goals, selecting among a hierarchy of goals, and selecting strategic variables. This decisional process involves opportunism, i.e., making decisions which will tend to insure that an organization will survive and thrive.

The concepts of homeostasis mechanisms and organizational equilibrium provide a basis for studying organizations as systems within a hierarchy of systems which are described by general systems theory. Through the use of systems theory, organizational theory can be greatly systematized. "System" implies both regularized interaction of system members through time and also interdependence of membership activities. Comparisons can be made between organic systems, small group systems, and organizational systems. Administrative organizations, when conceived as social systems, can be investigated and analyzed by theories, miniature type models, ideal type models, field studies, and laboratory experiments. These techniques need to be applied in study of the structure and the functional activities of a "whole" organization, i.e., both clientele and operating member activity must be investigated. Study needs to be made by structural-functional analysis in addition to study of "legal" structure and small group operating structure. Findings from such study should be compared with theories and models.

Administrative organizations containing bureaucratic structures provide an excellent means for utilizing the various techniques of analyzing organizational systems. Max Webers ideal type model serves as a tool in this analysis. Field studies made utilizing Weber's model can be compared. A new model can be constructed to account for organizational dynamics and informal organization. Investigation of bureaucratic structure also provides a means for anlayzing organizational policy formulation, "representative" bureaucracy, cooptation, and broker rule. Each of these elements of the operations of organizational structure, such as policy formulation, etc., must be viewed as processes, as activities involving interest conflict, adaptations, and compromise. Organizational processes of this nature require a consolidation of organizational theory with a theory of politics. The activities involved in the operating member-clientele member interactions and mutual adjustments cannot be explained without such a consolidation. Administrative organizations are themselves processes of making adjustments among conflicting interests and are also compromises of the process involved in the activities of conflicting interests. Governmental organizational systems cannot be conceived except as part of the governmental process.

In order to study administrative organizations as social systems through the consolidation of organizational theory and a theory of politics, an interdisciplinary approach is essential. General systems theory and equilibrium-process theory provide the foundation for such an interdisciplinary approach. This approach provides the administrative theorist with the concepts involved in a dynamic administrative organizational system which is self-maintaining, equilibrium tending, and feedback mechanism possessing.

Microfilm $3.40; Xerox $11.60. 263 pages.

STATE REGULATION OF PRIVATE EMPLOYMENT AGENCIES

(L. C. Card No. Mic 59-908)

Arthur Clare Marlow, Ph.D.
St. Louis University, 1958

This is a case study of a phase of public regulation of business. In 1848, more than a century ago, Massachusetts became the first state to adopt legislation designed to regulate the private fee-pay employment office. Statutes for this purpose are now on the books in more than forty jurisdictions. Since no definitive history of this movement has been written, and since no attempt to appraise the administration and enforcement of these laws has yet been made, this work appears warranted.

The initial chapter summarizes the transition in American political and economic life during the thirty-year period, 1860-1890. The development of the forces and causes which prompted the enactment of laws regulating private employment agencies is outlined. Among the major forces considered are those growing out of the changes in population, agriculture, industry, labor, and immigration.

Because the Supreme Court decision of Adams v. Tanner (1917) necessitated a change in tactics of those seeking to regulate the private job broker, that date is used as a division point in this study. In Chapter Two a detailed analysis is made of the earlier attempts at regulation by municipal, state, and Federal governments. The legislative processes and the pressure group activities which brought about these measures are critically examined. The experiments with new procedural devices and administrative techniques are also considered. The high

tide of the opposition to private agencies culminated in the efforts to secure Federal control over interstate agencies between 1914 and 1917. There has been a noticeable reduction in the amount of legislation and the vigor of enforcement since that time.

The movement to control the private employment office during the past forty years is traced in the third chapter. Although the legislative product is smaller in comparison with the earlier period, a number of improvements in administration were introduced in the states most concerned with protective labor legislation. Again special attention is directed to the Federal attempts to regulate interstate placement by agencies. The reasons for the declining interest of humantarian and reform groups in legislation of this character are presented.

The application of the judicial test to the legislative product and the administrative processes designed to implement the statutes is next considered. Only a few of the questions have been resolved. It is now established that such legislation falls under the authority of the state police power. On the problem of the legality of limiting fees charged by employment offices, the courts followed a meandering path. The New Jersey statute ran the judicial gauntlet in 1928 and was held unconstitutional. Thirteen years later a more restrictive law in Nebraska was upheld by an unanimous court. There is no longer any question of the legality of these measures as far as the Federal constitution is concerned; it is still a matter of conjecture whether a state court will approve this legislation in the light of the state constitution. The few cases on the interaction of administrative law and state regulatory agencies complete this chapter.

Finally, an evaluation is made of employment agency laws currently in force and suggestions are presented for their improvement. The Model Statute is used as a norm. Because the proposed legislation was drafted some years ago, changes are offered to make it more effective. It is believed that the administrative procedures outlined would raise substantially the level of enforcement. The study makes evident the need for strong state and Federal laws in case of a serious economic decline.

Microfilm $2.75; Xerox $12.00. 209 pages.

BUDGET STRUCTURE, BUDGET CONTROL AND PROGRAM CONTROL: A STUDY WITH PARTICULAR REFERENCE TO THE FINANCING OF CERTAIN BUSINESS-TYPE ACTIVITIES OF THE DEPARTMENT OF DEFENSE

(L. C. Card No. Mic 59-1512)

Clifford John Miller, Ph.D.
The American University, 1959

This is a study of the "political science aspects" of budgetary arrangements, tracing some principles of public policy control, budgeting and reform through the complex of financial arrangements in the Department of Defense. Financial arrangements relative to certain business-type activities are examined, since these illustrate a variety of approaches to budget structure, preparation, review and execution. The budget substructure in the Department of Defense is a large part of the framework for making some very significant policy decisions, and this area abounds in much raw material for contemporary study of American Government. In sheer statistical terms, this is a vast area. About 400,000 civilians, nearly one-fifth of Federal civilian employment, produce about $4 billion worth of goods and services annually in the Department's shipyards, ordnance and chemical plants, and activities engaged in sea and air transportation, terminal operations, overhaul and rebuild, research and development, and other operations.

The study centers upon the ways in which intragovernmental financial arrangements in this area relate to the requirements of an integrated budget structure, including: (a) accord with constitutional and legal requirements for budgetary control: (b) assuring proper consideration to economy in the use of public resources; (c) adaptability to the use of effective financial controls in agency management and (d) fostering meaningful program choice, setting forth clearly the relevant alternatives and providing means for carrying program choice into effect. Fulfillment of one of these requirements is not necessarily consistent with fulfillment of others.

Two early chapters are devoted to consideration of the intragovernmental systems and techniques employed in the Department of Defense, the existing budget structure and various factors making for change, especially proposals for reform. Four chapters are devoted to consideration of the elements of an integrated budget structure listed above, in terms of applications of systems and proposals to concrete situations in the logistical area. Industrial funds and various simplified allotment systems are studied in terms of their relationship to an integrated budget structure.

Beyond general sources, data were gathered from interviews; personal experience and observation; visits to business-type installations and headquarters organizations; staff papers; correspondence; reports, published and unpublished, and discussions with the authors. Accounting, statistics, and training in Federal budgetary administration and fiscal policy were valuable research tools. In addition to application of these tools to the sources listed, principal research methods used were interview and historical analysis.

Principal findings and contributions of the study lie in the following areas: (a) development of the distinctions between program control and management control, and the related matter of the distinctions between performance budgeting and organization-based budgeting; (b) the importance of the budget substructure, and its relationship to broad issues of policy and control; (c) tracing the outlines of the budget substructure, and defining its elements, from broad concepts to the action level; (d) demonstrating in a systematic way how these elements converge upon the major business-type activities of the Department of Defense; (e) analysis of the role of costs in military-industrial decision-making, and the demonstration that cost properly conceived and implemented, and not viewed in narrow accounting terms - here provides a valid criterion and (f) analysis of the means for relating "business-type" financial management systems to traditional budgetary controls and other requirements of an integrated budget structure.

Microfilm $6.15; Xerox $21.40. 482 pages.

PSYCHOLOGY, GENERAL

A DISCRIMINANT ANALYSIS OF THE APTITUDES AND INTERESTS OF ENLISTED MEN IN ELEVEN NAVAL AVIATION GROUPS

(L. C. Card No. Mic 59-1247)

Diane Ramsey Albitz, Ph.D.
University of Minnesota, 1958

Adviser: Kenneth E. Clark

This study demonstrated that aptitude and interest measures can be used to predict the ratings into which Navy recruits will ultimately advance. The results of this study indicate the usefulness of including measured interests with aptitude test scores in a discriminant analysis of occupational groups. Multiple discriminant analysis can be recommended for serious consideration as the most appropriate model for persons faced with classification problems.

Discriminant analysis poses three questions: 1) what is the distance between any two groups; 2) what is the direction of this distance; and 3) can a person known to be a member of a particular group be assigned to that group by this method?

In a sample of 751 enlisted men in eleven Naval aviation ratings, scores on an achievement test for each rating were ordered and each rating was split into a high achievement group and a low achievement group. Predictor variables used were the four aptitude test scores of the Navy Basic Test Battery (GCT, ARI, MECH, and CLER), and twelve empirically developed keys of the Navy Vocational Interest Inventory (AD, GM, ET, RD, CT, QM, EM, BM, DC, SK, AT, and AM). Differences among the group centroids on the predictor variables for high achievement, low achievement, and the total group were significant at the .001 level. These differences were also observed in a cross-validation sample of 567 men.

All pairwise inter-group distances (D^2's) were computed and tests of significance were made. A cluster analysis of the D^2's yielded four clusters for the high achievers: mechanical, operational, electronic, and clerical. For low achievers and for the total group, the mechanical and clerical clusters were identified but the operational and electronic clusters merged together.

Eleven linear discriminant scores (L-scores) were computed for each individual in the validation sample using discriminant functions calculated on the entire criterion membership. In addition, eleven L-scores were computed for each high achiever using discriminant functions calculated on high achievers, and eleven L-scores were computed for each low achiever using discriminant functions calculated on low achievers. All three sets of L-scores were computed for each individual in the cross-validation sample. An individual was predicted to belong to the group for which he received the highest L-score in each set of eleven.

An analysis of the number of correct classifications achieved was carried out for assignment to group and cluster of membership. Most of the tests of proportion of correct classification into group of membership in the validation sample were significantly different from chance beyond the .001 level. However, there was considerable shrinkage on cross-validation. All of the tests of proportion of correct classification into cluster of membership in the validation sample were significantly different from chance beyond the .001 level. Although there was some shrinkage on cross-validation, all of the cross-validation tests were significant beyond the .001 level. Discriminant functions based on high achievers did the most effective job of classifying individuals into both group and cluster of membership.

A canonical reduction of the original variables was performed to determine the minimum number of independent dimensions necessary to account for most of the variability among groups. In all three analyses two-thirds to three-fourths of the variance was accounted for by two canoical roots. Bivariate scatterplots of the coordinates of the group means on the first and third canonical variables corroborated the clustering of groups that emerged from the cluster analysis of the inter-group distances (D^2's).

Finally, the canonical variables were expressed as linear functions of the original variables so that the weights corresponding to each original variable in the linear equation for each canonical variable could be examined.

Microfilm $2.25; Xerox $8.00. 171 pages.

MONADIC AND DYADIC STUDIES OF DECISION-MAKING AND CONFLICT RESOLUTION

(L. C. Card No. Mic 59-1431)

John Milburn Atthowe, Jr., Ph.D.
Stanford University, 1959

Conflict resolution was studied as a special case of decision-making. The experimental program was designed to discover some of the factors which determine the severity (strength) of a conflict. Conflict severity was measured by the degree of non-rationality of a decision and the time it takes to reach a decision. Three major problem areas were explored. The first problem area was concerned with the relationships between conflict severity on the one hand and the situation of choice and individual differences on the other. The second problem dealt with the interpersonal situation of conflict. Differences in the choice situations, differences between individuals, and differences arising out of the interaction between individuals were related to the severity of a conflict. The third problem was the comparison between the monadic and the dyadic situations of conflict.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Six types of choice situations, or conflicts, were presented under both monadic and dyadic conditions. The choice situations were defined in terms of the anticipated reinforcing characteristics, both positive and negative, inherent in the outcomes of the choices. The subject's task was to choose the more preferable of two possible choices, or alternatives. Each alternative consisted of two possible outcomes. The probability of occurrence of either outcome was always one-half. The incentives associated with each of the outcomes were positive (gains) and negative (losses) values of money.

The task resembled a gaming situation. The instructions were designed to induce a reasoning attitude and moderate to strong achievement motivation. The decision choice and the decision time were determined for each of the six choice situations at the point of indifference between the competing alternatives. The indifference point represented the point of maximum conflict and was assumed to be functionally equivalent for all decision-makers. The absolute and the expected values of the outcomes were equated. No money was dispensed in the experimental sessions.

Thirty-two male students served as subjects, first individually and later in pairs. The decision choice in the dyadic setting required a mutual agreement. A non-rational decision was defined as a deviation in cents away from a mathematically correct strategy. The correct strategy was to choose the alternative containing the maximum expected payoff, or minimum expected loss if no gain was possible.

Distribution-free statistics were used to test the significance of the results. In the monadic situation, the measures of conflict severity were independent each of the other. Non-rationality was largely a function of the uncertainty inherent in the choice situations, and decision time was mainly a function of the risk present. In the dyadic setting, the measures of conflict severity were interdependent. The severity of the dyadic conflict was chiefly a function of uncertainty.

In both the monadic and dyadic conflicts, the typical decision strategy employed was to try to minimize one's losses rather than to maximize one's gains. The type of choice situations and the degree of equivalence of the competing choices were significantly related to conflict severity in both settings. The properties of the interaction sequence and the initial differences in performance of the partners were also related to the severity of the dyadic conflict.

In general, the monadic conflict was more non-rational, and the dyadic conflict took longer to resolve. The dyadic situation also showed more consistency in response patterns and greater variability among specific responses. The dyadic decisions were as rational or more rational than the monadic decisions of the partners when the less conservative member of the dyad emerged as the influencer and when the degree of verbal interaction was minimal. Expertness was associated with decisions that were both more rational and quicker.

Microfilm $2.00; Xerox $4.80. 92 pages.

MEASURED PERSONALITY CHARACTERISTICS OF LIBERAL ARTS COLLEGE FRESHMEN

(L. C. Card No. Mic 59-1254)

Frederick Gramm Brown, Ph.D.
University of Minnesota, 1958

Adviser: Wilbur L. Layton

The purpose of this study was to investigate the usefulness of the Minnesota Counseling Inventory with college freshmen. Students (1027 men and 1169 women) at six Minnesota liberal arts colleges served as subjects.

Analyses of variance showed that freshmen men and women differed significantly. Women obtained higher mean scores on all except the Family Relationships and Conformity scales. College freshmen, both male and female, obtained significantly lower mean scores on all diagnostic scales than did high school juniors and seniors.

Similarly, analyses of variance were used to investigate the differences in MCI scores between various colleges. Inter-college differences were present for both men and women. The mean scores by college were arranged hierarchially, rather than certain patterns of scores being characteristic of individual colleges. The Emotional Stability and Reality scales were best able to differentiate the colleges. Several factors that may underly the inter-college differences were suggested and discussed.

To obtain evidence on the validity and meaning of the MCI scales within the college population, dormitory counselors were asked to nominate students who fit certain behavioral descriptions that were designed to measure the psychological variables underlying the various scales. Mean differences between the nominated and not nominated were compared by critical ratios and t tests. Analyses were done separately for men and women, both within individual colleges and on combined groups constituted of all students of the same sex. The results indicated that the Family Relationships, Social Relationships, Conformity, and Leadership scales should be most useful to college counselors. The Emotional Stability and Mood scales appeared valid for women but not for men. The Reality scale gave no indication of being valid. These imperfect differentiations, however, may be a function of the rating procedure rather than of the scales.

MCI scores of several objectively determined groups were compared to scores of the other, or average, students. Student leaders scored lower on the Leadership scale and disciplinary cases scored higher on the Conformity scale than did the average student.

Profiles of students who dropped out of college, for any reason, were compared to the profiles of the average students at their college. Both men and women drop-outs tended to obtain generally elevated profiles. The men drop-outs, however, appeared to be irresponsible and non-conforming while the typical female drop-out was withdrawn and depressed.

Microfilm $2.00; Xerox $5.80. 120 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

DIFFERENTIAL JUDGMENTS OF MANIFEST ANXIETY, DEFENSIVENESS, AND EFFECTIVE PROBLEM SOLVING IN COUNSELING

(L. C. Card No. Mic 59-1275)

Walter Orwell Jewell, Ph.D.
University of Minnesota, 1958

Background. This study grew out of the University of Minnesota Student Counseling Bureau's project "Research in Counseling and Case Work" which defined counseling as decreasing anxiety and defensiveness, and increasing problem solving. However, in the major experiment of the Bureau's project no changes were found to have occurred as a result of counseling.

Purpose. The purpose of this experiment was to study, using expert judgments, the presence or absence of Effective Problem Solving, Defensiveness, and Manifest Anxiety in the first interview, and the goals for or achievements of the counselors in producing changes in these variables in subsequent counseling. It was hypothesized that judges could identify and agree on the presence of the variables; the task of the counselor was to assess the presence, strength, and role of the variables at the onset of counseling, and to afford different treatment for each unique client. It was also hypothesized that judges could identify the counselor's goal or achievement.

Procedure. Twenty counseled cases randomly selected from the Bureau's experimentals were rated by two teams of three judges. The ratings were made from the case materials and listening to recorded interviews. Both teams rated each case for the presence of the variables in the first interview. One team then judged what the counselor's goals should be; the other team from the complete counseling record and final interview judged what the counselor had achieved. Individual ratings and a Team rating of two or more judges in agreement following case discussion were obtained for each case for the First, Goal, and Achievement ratings.

Results. The two teams judged that 75 per cent or more of the cases were not evidencing problem solving in the first interview, between 50 and 75 per cent were defensive, and 60 per cent were anxious. There was 75 to 80 per cent agreement between teams on their first interview ratings of the three variables. The agreement for Defensiveness and Anxiety was statistically significant.

For the goals, all cases were judged to require an increase in Problem Solving; 60 per cent of the cases were judged to require no change in Defensiveness and 40 per cent to require a decrease; and on Anxiety, half of the cases should not change, a third should be decreased.

The achievement ratings indicated that the judges felt that the counselors did not change any variable in half to two-thirds of the cases, and from 20 to 35 per cent increased.

The congruence between Goal and Achievement ratings ranged from 25 per cent for Problem Solving to 65 per cent for Anxiety.

The congruence between the Goal ratings and the agreement between the Achievement ratings with the counselors' change in status ratings ranged from 35 to 60 per cent.

Comparisons of the Counseling Bureau's experimental counseling tests with the Team ratings indicated the pretest means of the "Evident" cases in the first interview were significantly greater than the pretest means of the "Not Evident" cases. No differences were found for the means of the Goal and Achievement ratings or for changes between pre-and posttests.

Conclusions. It was concluded that: Judges could identify and agree on the presence of Anxiety and Defensiveness; not all cases are defensive or anxious initially; the results of the Counseling Bureau's experiment and this experiment support each other in that no changes were found in the three variables as a result of counseling suggesting that these variables might not be realistic for short-term counseling.

Several suggestions for further research were also presented. Microfilm $5.15; Xerox $18.20. 404 pages.

AN INVESTIGATION OF THE EFFECTS OF STRESS AND ANXIETY ON SUBJECTS WITH NON-DOMINANT HEMISPHERE LESIONS

(L. C. Card No. Mic 59-1015)

Bertram Kirsch, Ph.D.
New York University, 1958

Chairman: Professor Howard M. Newburger

It was the purpose of this investigation to study the relationship between stress and anxiety and cognitive, emotional, and perceptual processes on brain-damaged subjects in a rehabilitation setting.

The subjects in this study were twenty male and female patients who were being treated for the residua of non-dominant hemisphere left hemiplegia at Woodruff Hospital. The subjects were of at least Average intelligence (IQ 90 and above), with a negative psychiatric history, and had had only the one cerebral organic involvement. The subjects were examined for the purposes of this study only after two or more weeks of hospitalization.

The subjects were tested and re-evaluated twice in order to measure the changes in intellectual function, perceptual efficiency, and personality organization. Each subject was examined under non-stress (Conditon A), stress (Condition B), and stress plus experimentally induced anxiety (Condition C). Each patient was evaluated with the following battery of psychological tests: 1) Draw - A - Person Test; a) Goodenough Scale, Steinman Scale; 2) The Bender Visual-Motor Gestalt Test; 3) The Sherman Mental Impairment Test; 4) The Wechsler Adult Intelligence Scale, Digit Symbol subtest; 5) Trail Making Test; 6) Motor Inhibition Test; and 7) Days and Months Test. There was an alternation between Conditions A and B to control for the effects of learning.

To ascertain whether there was a significant difference between the thirteen measures on the seven tests, analysis of variance procedures were employed to explore the hypotheses of this study. The results indicated that the null hypothesis was sustained for each individual measure at the (.05) level. Not one of these measures was able to demonstrate a significant alteration in performance in the several Conditions.

A further analysis of variance was made to investigate the possibility of a small, but consistent, test performance difference in a constant direction. Numerical rankings of the average performances of all the measures (from best

to poorest performance) under the various Conditions were made. The test Conditions, grouped by rank, demonstrated that the variation among the Conditions was greater than could be expected by chance (.001 level). The results suggested that the total test performance was significantly better in the morning under non-stress Conditions than in either of the two afternoon Conditions.

The analysis of the Draw - A - Person Test revealed a significant correlation (.01 level) between the Steinman Scale scores (index of emotional disorganization) and the Goodenough Scale scores (maturation index).

The drawings were also analyzed to determine the order of sex production. It was found that men drew more men first and women drew more men first at beyond the (.01) level of significance. In addition, the subjects who produced profile drawings tended to draw them facing to the left side of the page significantly more often (at the .001 level).

The general conclusions that may be drawn from this study are as follows: The individual measures were not able to differentiate between the various Conditions. However, when the various performances were taken in their entirety, subjects with non-dominant hemisphere left hemiplegia tended to give a more accurate picture of their capabilities when evaluated in the morning under non-stress conditions.

Microfilm $2.00; Xerox $6.20. 129 pages.

THE EFFECTS OF STRESS ON METHYLCHOLANTHRENE INDUCED SKIN CANCER IN THE SWISS ALBINO MOUSE

(L. C. Card No. Mic 59-1348)

Robert Eugene Lefton, Ph.D.
Washington University, 1958

Chairman: Dr. John A. Stern

The purpose of this study was to test the hypotheses that:

1. A variety of environmental stressor agents would enhance the growth and development of methylcholanthrene induced skin papillomas in Swiss white mice.
2. The temporal relationship between the exposure to stress and carcinogen application had a differential effect on the speed of cancer development.
3. Mice subjected to a noxious or intense stressor agent would develop papillomas more rapidly than animals exposed to a less noxious or intense stress.

Three hundred and ninety-one Swiss albino mice were the subjects of this experiment. The animals were of a strain which had been found to be susceptible to methylcholanthrene induced skin cancers. The subjects were randomly divided into seven main groups of approximately fifty-four animals each. Six of these groups of mice were subjected to such environmental stresses as heat, cold, enforced activity, conditioned "anxiety," electric shock, and mixed stress (random alternation between heat and cold), while the seventh group served as the no stress control group.

Each of these seven main groups was divided into two subgroups, making a total of fourteen groups of approximately twenty-seven animals each. One subgroup, designated the prior stress group, was subjected to its particular stressor agent twenty days before the first day of carcinogen application. The other subgroup, designated the concurrent stress group, was subjected to the stressor agent concurrently with the carcinogen. Each subgroup was subjected to its particular stressor agent for seventy consecutive days.

Each subgroup of animals was housed in a separate cage. Food and water was available ad libitum except for the five hours each day in which the animals were subjected to their particular stressor agents. The age of all animals at the inception of the experiment was between forty and forty-five days. All fourteen subgroups of animals were painted with the carcinogen at sixty-two days of age.

Cancers were evaluated according to size and malignancy. Size was rated on a five point scale. Malignancy was evaluated by classifying the cancer as papilloma, precancerous, or carcinoma.

The following conclusions were drawn from the investigation:

1. Most of the stressors utilized enhanced the speed of development of methylcholanthrene skin papillomas to some degree. Concurrent heat, concurrent activity, concurrent mixed stress, and prior mixed stress groups differed significantly on Chi Square Tests from the control group at various chronological points in papilloma development. On the Wald-Wolfowitz Runs Test these above mentioned groups were reliably above the control group in rate of growth and development of papillomas when the curves of papilloma development were compared. The experimental groups of prior activity, prior electric shock, prior heat, concurrent cold, and concurrent conditioned "anxiety" did not differ statistically from the control group at specific points of papilloma development, but were reliably above the control group. Prior cold, prior conditioned "anxiety," and concurrent electric shock were the only stress groups which did not differ statistically from the control group at specific points, nor were they reliably above the control group in papilloma development.

2. All the concurrent stress groups, with the exception of prior electric shock, enhanced the rate of growth and development of papillomas to a greater degree than their prior stress counterparts. These findings demonstrate that the temporal relationship between exposure to stress and the application of the carcinogen is an important variable in papilloma development.

3. Mice subjected to mixed stress, in our opinion the most noxious or intense stress used in this study, manifested the most marked increase in the rate of growth and development of papillomas. The two mixed stress groups reached a higher percentage of medium and large papillomas than any of the other prior and concurrent stress subgroups.

It was suggested that hormonal imbalance due to the exposure to stress might account for the results obtained regarding the rate of growth and development of cancer.

Microfilm $2.05; Xerox $7.40. 156 pages.

AMOUNT OF INFORMATION AS A VARIABLE IN ACCURACY OF JUDGMENT

(L. C. Card No. Mic 58-7289)

Paul Joseph Lilly, Ph.D.
The Pennsylvania State University, 1958

PROBLEM

The present study was designed to investigate the effect of varying amounts of information on accuracy of judging human behavior with statistical control of any pertinent personality variables in the judges by the method of analysis of covariance. The general hypothesis was:

> Unsophisticated judges, with more than minimal information about the subjects to be judged, will be more accurate in their predictions of subjects' responses than similar judges with only minimal information, when adjustments are made for individual differences in pertinent personality variables.

Subordinate hypotheses planned for investigation were:

1. Consistent individual differences in accuracy of prediction by judges can be demonstrated.
2. The motivational system of the judge as measured by the need variables of the Edwards Personal Preference Schedule is related to the accuracy with which the judge can predict subjects' responses.

PROCEDURE

Two random samples of 60 female college freshmen were used as judges to determine the effect of two contrasting amounts of information on the accuracy with which judges could predict the responses of two subjects - - a 16 year old Catholic girl, and a 16 year old Jewish girl - to interpersonal problem situations adapted from the Sargent Insight Test.

For each subject the judges were administered a 20 item, multiple-choice test, where a paraphrase of the subject's actual response was one of the four alternatives for each item, and the other three alternatives represented other likely responses.

Group I judges were given only minimal information about each subject, being told that Subject A was a 16 year old, 12th grade, Catholic girl, attending a private school conducted by Catholic nuns; and that Subject B was a 16 year old, 11th grade, Jewish girl, attending a large public high school. They were told that each subject had been presented with these problem situations and asked what the "typical young girl" would do in each situation, and how she would feel. They were asked to judge which of four alternatives to each item represented the paraphrased response of the subject. After predicting for Subjects A and B, the judges took the Edwards Personal Preference Schedule. This was intended to obtain information concerning the need variables of the judges in accordance with the hypothesis that such measures might be related to accuracy of judgment.

Judges in Group II were presented with the same multiple-choice tests for Subject A and B that had been given to the Group I judges. However, they listened to the actual tape-recording of the subjects and heard the brief interview with each concerning additional information about the subject's family, vocational goal, father's occupation, etc. Then, as each problem situation was posed to the subject by the experimenter on the tape, the machine was stopped until the judges predicted the subject's responses to each situation. Then the tape started again and the judges heard the actual responses concerning the action and feeling of the typical young girl. They learned immediately how accurate their predictions were, and acquired more information about the subject as the tape continued. All Group II judges also completed the Edwards Personal Preference Schedule.

RESULTS

The mean accuracy scores for Group II proved to be significantly higher than corresponding scores for Group I, for both subjects, and on both action and feeling responses. All differences were significant at the 5% level in the hypothesized direction. A single-tailed F test revealed that the groups did not differ significantly in variability of accuracy scores, which suggested that the tape-recording group as a whole tended to utilize the additional information in judging.

When judges' accuracy scores for Subject A were correlated with scores for Subject B, the resulting coefficients were .044 for Group I and .006 for Group II, indicating complete lack of consistency in accuracy of prediction from one subject to another. Since there was no reliability in predicting from one situation to another, one could not adjust such scores for differences in personality variables.

Microfilm $2.00; Xerox $5.20. 102 pages.

FAILURE-AVOIDING AND SUCCESS-STRIVING BEHAVIOR IN MENTALLY RETARDED AND NORMAL CHILDREN

(L. C. Card No. Mic 59-1111)

James William Moss, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Rue L. Cromwell

The purpose of this study was to experimentally examine the usefulness of a theoretically derived personality construct in the differential prediction of learning achievement. The personality construct, "success-striving vs. failure-avoiding," was derived from Rotter's social learning theory. Rotter's postulates led to the consideration that the description of behavior in approach and avoidance terms would have some utility. Behavior could be described as "approach" if the individual were observed to respond primarily to goal-related in his environment. It could be described as "avoidant" if he responded primarily to cues associated with potential threat. Rotter further points out that behavior is a function of expectancy and reinforcement value.

The concepts of directionality and expectancy led to the formulation of the "success-striving vs. failure-avoiding" construct. The success-striver, at one pole of the continuum, was described as an individual with a high expectancy that he could achieve success. He would be relatively unconcerned with the possibility of failure. At

the other end of the continuum, the failure-avoider was described as a person with a low expectancy for success. This individual would be greatly concerned with avoiding failure in a given situation and would respond to cues which might keep him from additional failure.

The usefulness of this construct was examined by comparing the learning behavior of children classified on a priori grounds as success-strivers and failure-avoiders. The success-striving group was composed of 38 normal, second grade children who scored above the second grade median in academic achievement. The failure-avoiding group was composed of 39 mentally retarded children in regular public school classes who were below grade level for their age in academic achievement. The mental age levels of the two groups were essentially equal, the retarded children being chronologically older. Predicted differences in learning were based on the notion that the learning of the failure-avoider would be handicapped in a complex situation because of his concern for the potential failure inherent in the situation.

The children were first tested on a multiple-response, discrimination-learning apparatus. Four stimuli were presented simultaneously, one of which was associated with failure, one associated with success, and two which were neutral. Subjects in the two groups were matched on their ability to learn this task, and then tested on a standard, two-stimulus discrimination learning task.

None of the hypotheses in the study were confirmed.

Microfilm $2.00; Xerox $4.20. 80 pages.

A DIAGNOSTIC FORCED-CHOICE EVALUATION OF HIGHWAY PATROLMEN

(L. C. Card No. Mic 59-411)

Sherwood Harry Peres, Ph.D.
The Ohio State University, 1958

This study was intended to show that a diagnostic forced-choice scale could be used not only to evaluate general performance of highway patrolmen but, also, through a modification of the forced-choice technique, to produce diagnostic profiles that could be utilized in guidance and training.

Three hundred and ninety-five descriptive phrases of patrolman behavior were sorted into five sub-areas of patrolman performance. The two hundred and twenty-nine phrases on which there was most agreement were administered in check list form to supervisory officers who assigned applicability values to them in reference to their "best" and "poorest" patrolmen.

Responses provided data for calculating preference indices, discrimination indices, and intercorrelations between sub-area scores. The correlation matrix of the sub-areas was factor-analyzed into a general factor and four specific factors. Factor loadings of each phrase on each specific factor were computed.

The Patrolman Performance Report was composed of three sections. Part I consisted of twenty sets of descriptive phrases, with each set containing four phrases matched on their preference value but having different discriminative value as related to job success.

Part II of the Report was the Descriptive Ranking section. The Descriptive Ranking was composed of ten sets of four statements each. The phrases within each set were equated as closely as possible on preference indices, discrimination indices, and loadings on the general factor. Each phrase had a substantial loading on a different one of the specific factors representing sub-areas of patrolman performance.

Part III of the Report was composed of five adjectival paragraphs written to depict each one of the sub-areas and also over-all general performance. Below each paragraph was a twenty-point scale on which the rater was to indicate, by circling a number, how well the paragraph described the patrolman.

The "buddy-rating" technique was used to establish an external criterion. Buddy ratings were obtained on every patrolman in the state in June, 1957. In order to obtain the reliability of the criterion, the buddy ratings were run again six months later, in November, 1957. The reliability coefficient was .81.

Four hundred and fifty-five highway patrolmen were evaluated by the Performance Report. All raters held the rank of Corporal. The raw scores were used to compute product-moment correlations between the component sections of the Report and the criterion.

The over-all forced-choice performance section correlated .53 with the criterion, while the adjectival paragraphs on the summary sheets correlated from .06 to .14 with the criterion.

Skewness and kurtosis were computed for the curves representing the distribution of scores obtained from the over-all performance forced-choice section and for the adjectival paragraph written to depict general efficiency.

The forced-choice section yielded a symmetrically distributed, slightly platykurtic curve; while the adjectival paragraph yielded a negatively skewed, leptokurtic curve.

Percentile norms on a state-wide basis were established for the over-all performance forced-choice section and for each of the categories in the descriptive ranking section.

In the group of four hundred and fifty-five patrolmen, the years of service ranged from one to thirteen years. The correlation between Performance Report scores and seniority was .158, which was significant at the 1 per cent level of confidence.

The study has provided further evidence that the forced-choice technique and a modification of the technique can be utilized for measuring over-all performance level, and can also produce diagnostic profiles for guidance purposes. Microfilm $2.00; Xerox $5.80. 117 pages.

DECISION MAKING AS A FUNCTION OF PERSONALITY, ENVIRONMENT, AND RISK: AN INVESTIGATION OF THE INFLUENCE OF PERSONALITY, ENVIRONMENT AND RISK ON DECISION MAKING AS INDICATED BY THE RELATIONSHIP BETWEEN SOCIAL ASCENDENCY AND PREDICTIONS OF AN OBSERVABLE EVENT OCCURRING AT TWO DIFFERENT ESTABLISHED FREQUENCIES IN MONETARY AND SOCIAL RISK SITUATIONS AND WITHOUT RISK

(L. C. Card No. Mic 59-1034)

Harvey Queen, Ph.D.
New York University, 1958

This experiment was concerned with four, previously unrelated, specific variables: social ascendency, event probability, risk and psychological probability. It represents the second of a series of investigations relating the areas of personality, environment, and decision making.

Subjects: Two hundred and thirty-nine graduate and undergraduate male students and fourty-four male non-executive business personnel were tested along the social ascendency variable, and through the use of previously established norms, two experimental samples were formed from these groups. The two experimental samples consisted of 84 students and 28 business personnel Ss, each classified by the A scale of the GAMIN Inventory into two social ascendency categories (A = High and Low).

Procedures: The standardized performance task employed required the S to predict, in each trial of a series, which of two alternative events would occur following a warning signal. There were two fixed proportions of alternative event$_1$ to event$_2$ (eP = .6 and .7) which represented the points along the environmental variable considered. There were also three risk conditions under which student Ss executed the standardized task (R = monetary, social and no risk). These risk situations together with the two event probabilities described above, defined the experimental conditions. In making the predictions, a subject was estimating the frequency of occurrence of an observable event. This personal estimation represents a psychological probability (Psi P). The principle measure obtained was along the variable of psychological probability. For purposes of analysis, the event predictions were transformed into deviation scores from the appropriate event frequency. For the student experimental sample, a 3x2x2 factorial design and analysis of variance was utilized to test twenty-one hypotheses specifying the relationships among the three independent variables, social ascendency, event probability, and risk, and the dependent variable, psychological probability. A separate 2x2x2 factorial design and analysis of variance involving a comparison of the data from the student experimental subgroups performing under the no risk condition, and the data from the performance of the business personnel subgroups, also was utilized to test the significance of occupation as a variable.

Results: Psychological probability was found to be influenced by social ascendency taken alone (beyond the 1% level of significance) and to a lesser degree (but also significant beyond the 1% level) by event probability taken alone. Psychological probability was also found to be influenced by these two factors considered jointly. The interaction was significant beyond the 5% level. The risk variable, although very close to the 10% level of significance, was not found to be a significant influence on psychological probability when taken alone or considered jointly with event probability and/or with social ascendency. Occupational category (i.e., students as opposed to non-executive business personnel) was markedly of no significance as an influence on psychological probability. Evaluating differences within significant categories by the t test, it was found that within both the .6 and the .7 event probabilities, high social ascendency Ss did significantly better (beyond the 5% and 1% levels of significance, respectively) than low social ascendency Ss. Low social ascendency Ss' predictions of the more structured (P = .7) event probability situation were significantly better (beyond the 1% level) than those of the more ambiguous (P = .6) event probability situation. Statistical tests concerning the appropriateness of the experimental and statistical techniques employed were positive.

Results were discussed along the lines of relevance to the areas of decision behavior, personality, risk, learning and education. In addition, the methodological significance of the research was indicated and suggestions for future research and application of the methodology in the various areas were described.

Microfilm $2.00; Xerox $5.40. 108 pages.

ENGLISH SKILLS OF FOREIGN GRADUATE STUDENTS

(L. C. Card No. Mic 58-7407)

Ruth Roberts, Ph.D.
University of Minnesota, 1958

Adviser: Donald G. Paterson

The purpose of the study was two-fold: first, to provide local information about the need for and effectiveness of varying amounts of English instruction for foreign graduate students from non-English-speaking countries; and second, if the instruction proved effective, to obtain support for continuing the program on a permanent basis.

Procedures: During 1954-1955 all new foreign graduate students took a five-hour battery of group administered English tests and one non-verbal intelligence test at entrance and after six months in residence. Disregarding test scores, 25 of these students were placed in a very limited two-quarter English course and the others were used as a control group from which all English instruction was withheld.

In 1955-1956, the entrance testing was revised, and the instruction was intensified and made more flexible. Using predetermined cutting scores, the Graduate School recommended instruction in those aspects of English in which the students needed most. Students who scored above these cutting points were exempt.

During the summers of 1955-1957, intensive English programs were provided for special groups of graduate students with very limited English proficiency.

Hypotheses: The principal hypotheses tested were:

first, that English instruction for foreign graduate students should produce significantly greater improvement in tested English communication skills than a comparable period of residency without instruction; and second, that increased ability to communicate in English should be reflected in grades if intellectual capacity, emotional maturity and academic preparation are adequate.

Analysis: The criteria used were test scores and grades in academic courses. When test scores were the criterion for differences over a time period and between groups, "t" and "F" were used to test differences in means and variances, respectively. Analysis of covariance was used on major tests.

When grades were the criterion, mean honor-point ratios were used, trends in grades were examined by quintiles based on entrance tests, and a X^2 analysis was used to test cutting scores.

Results: 1. Students who received the limited instruction offered in 1954-1955 gained significantly more on tests and maintained better grades than students in the control group, but this instruction was not sufficient to bring the lower 30 per cent to a level of English proficiency necessary for course work even in engineering.

2. The revised 1955-1956 English program produced greater improvement in two months than the 1954-1955 course did in six months, but was not sufficient for the lower 10 to 15 per cent.

3. On most tests, the three intensive courses produced as much improvement in five and one-half to seven weeks as the 1954-1955 experiment did in six months or the 1955-1956 revised program did in two months, but still was not sufficient for students whose English tested in the lowest five per cent among foreign graduate students at Minnesota.

4. The cutting scores on all tests, singly and in combination, successfully differentiated students who maintained satisfactory grades from those who did not.

5. Students who scored below the cutting points had a significantly better chance of continuing work toward a graduate degree if they attended English classes.

Conclusions: The revised English program for foreign students at Minnesota is adequate for most foreign students admitted to the Graduate School. An intensive course of six to eight weeks prior to registration is needed for students who test in the lower 10 to 15 per cent of this group. Better selection in terms of academic ability within a student's native country would further reduce failures and make the English instruction still more effective.

Microfilm $3.40; Xerox $11.60. 264 pages.

SOCIAL CONFORMITY IN A COLLEGE FRATERNITY

(L. C. Card No. Mic 58-3124)

Richard Clark Sprinthall, Ph.D.
Boston University Graduate School, 1958

Major Professor: Philip Nogee

Our problem was concerned with analyzing perceptual conformity at two general levels, subjective and semi-objective. We have defined subjective conformity as the relationship existing between an individual's perception of his own behavior and his perception of norms or standards for that behavior. At the semi-objective level, conformity was defined as the relationship between an individual's perception of behavior and an objective standard for that behavior in his membership group. From this we analyzed eight different types of conformity, four at each level. At the first level we described purely subjective aspects of an individual's perception of his own conformity, whereas at the second level we were able to assess the accuracy of the individual's perception of the group norm and his conformity to it. These eight types of perceptual conformity were also related to other variables, such as type of situation, sociometric choice, elected leadership, academic success and length of group membership.

The sample chosen consisted of members of a college fraternity, all of whom had known each other for at least one year. The subjects were exposed to a static set of conditions, and we attempted to show both that their responses differed reliably and related to other variables. The measuring instrument, called the "Social Situations Test", consisted of forty situations in which members of a college fraternity could presumably find themselves. The situations fell into four broad social areas, that is, ten situations involve interaction with a high status figure, ten with a low status figure, ten with a peer and ten with a family member. Each situation was followed by five behavioral alternatives, and the subject was instructed to check, first, the one which most closely coincides with what he would do, secondly, the one he thinks the average member of the group would do, and, finally, the one which he feels is the best or ideal way in which to respond.

The data was handled in two main ways, analysis of the group and analysis of the individual. In analyzing the group data we assessed the amount of consensus for each item in the four areas. When the areas are then compared in terms of this consensus, we found significant differences. The most consensus was obtained on items from the family area, next most for high status items, next for peer items and least for low status items. We also compared the group responses in terms of the choice-scale, and again we obtained significant differences. The most consensus was with the ideal choice, that is, there was the most agreement when they were asked to indicate the ideal way in which to respond. The next most consensus was on self choice, and the least occurred when they had to choose what the average person would do.

The data on individuals was handled by constructing eight scales, each measuring a different aspect of conformity, and each was checked for reliability. The four scales measuring subjective conformity distinguished three types of individuals, those whose perceived actions conform with their perception of the ideal, or what Riesman might call an "inner-directed" individual, those whose perceived actions conform with their perception of what the average college man would do, or what Riesman might call "other-directed", and finally, those whose perceptions of own behavior conform to neither their perception of the ideal nor the average, or what we have called the idiosyncratic individual.

The major findings from these data were:

1. No differences were found between the amounts of inner and other direction; no differences either when the group is broken down into sophomore, junior and senior classes.

2. The other-directed individual was found to be more accurate in assessing group norms than was the inner-directed. The idiosyncratic individual, however, was in the most error.

3. The inner-directed individual was found to be more of an objective or real conformer to group norms than was the other-directed. The idiosyncratic individual was less conforming on this than the other-directed, but this was not significant.

4. Sociometric ranking related to whether or not an individual lived in the fraternity house, but did not relate to anything else. That is, although high sociometrics were more apt to live in the fraternity house, they were no different with respect to inner direction, other direction, accuracy of group norm prediction, class, and even tended to show less real conformity.

5. Although accuracy in prediction does differentiate the other-directed, inner-directed and idiosyncratic individuals, this accuracy is not related to length of group membership, or, as stated above, to sociometric rank.

6. No differences were found between amounts of perceived conformity and amounts of real conformity.

7. No relationship was found between sociometric rank and elected leadership, nor were the elected leaders found to differ in accuracy of prediction or in real conformity. There was a significant difference, however, which shows the elected leaders to be more inner-directed.

Microfilm $2.00; Xerox $4.60. 86 pages.

RELATIONSHIPS OF INTELLIGENCE AND SEX TO DIVERSITY OF INDIVIDUAL SEMANTIC MEANING SPACES

(L. C. Card No. Mic 59-596)

Edward Ernest Ware, Ph.D.
University of Illinois, 1958

The present study was an attempt to investigate the relationships of intelligence to diversity in individual semantic meaning spaces. An individual semantic meaning space in the present study was the multi-dimensional space defined by a set of 20 Semantic Differential scales on which a set of 31 representative concepts were rated by the individual. The major hypothesis was that persons of higher intelligence show greater diversity in their semantic meaning spaces than do persons of lower intelligence. The relationship between diversity of individual semantic meaning spaces and sex was also investigated.

The subjects were 138 high school juniors and seniors, of whom 27 were eliminated for failure to make adequate use of the seven scale categories of the Semantic Differential scales. The remaining 111 were divided into three IQ groups, a high group of 38 subjects, a middle group of 35 subjects, and a low group of 38 subjects.

Six related measures of diversity of the semantic space were used. The six measures were computed for each subject. They were as follows: 1. the average standard deviation on the 20 scales; 2. the generalized variance for a representative set of ten of the scales; 3. the percentage of variance extracted by the first factor derived from the intercorrelations of the 20 scales for each subject; 4. the cumulative percentage of variance extracted by the first three factors; 5. the number of factors required to account for 70 per cent of the variance; 6. the $\overline{H}$ measure, devised by Shannon and used in information measurement, applied to the percentages of variance for those factors extracting the first 70 per cent of the variance.

Two procedures were used to investigate the relationship between the above six measures of diversity and intelligence. First the Wilcoxon matched-pairs signed-ranks test was used in testing the differences on the six measures for 22 pairs of subjects selected from the extreme IQ groups and matched for reliability and sex. Next the Kruskal-Wallis sum of ranks for more than two groups was applied to the scores on the six measures for the three IQ groups, high, middle, and low. In both cases no evidence was found to support the hypothesis of a relationship between diversity of the semantic meaning space and intelligence. Also, using the Mann-Whitney sum of ranks tests for two groups on the scores on the six measures of diversity for 49 males and 50 females, no evidence was found to support any hypothesis of a relationship between sex and diversity of the semantic meaning space.

Reliabilities of the measures of diversity of the semantic meaning space, computed by dividing the 20 scales into two sets of ten, ranged from .47 to .77 and were all statistically significant beyond the .01 level except one which was significant at the .0114 level.

The intercorrelations between the six measures of diversity revealed two relatively independent clusters. The first cluster contained the average standard deviation and the generalized variance, and the second cluster contained those measures obtained by the factor analyses. The lack of correlation of the measures of variance in the univariate case (the average standard deviation) and in the multivariate case (the generalized variance) with the degree of intercorrelation of the scales, as evidenced by those measures derived from the factor analyses, necessitated a re-evaluation of the general concept of diversity of the semantic meaning space.

Microfilm $2.00; Xerox $5.20. 101 pages.

PSYCHOLOGY, CLINICAL

THE RELATIONSHIP BETWEEN RELIGIOUS BELIEF AND DEATH AFFECT

(L. C. Card No. Mic 58-7809)

Arthur M. Adlerstein, Ph.D.
Princeton University, 1958

The basic hypothesis under consideration is that religious belief has as a function the reduction of negative affect toward death. This hypothesis was tested by carefully selecting two populations, religious and non-religious, and comparing their responses to the concept of death on several different response indicators. From an initial population of 304 Princeton Undergraduates, twenty-five were selected in each group.

A word association test, The Semantic Differential, a prepared questionnaire, an open-ended interview and a manifest anxiety scale were administered. Our central concern was the change in "manifest anxiety" resulting from a face-to-face discussion about the meaning of death.

One half of the manifest anxiety scale was presented immediately following the word association task. Intervening between the first and second half were the Semantic Differential, prepared questionnaire and open-ended interview.

The results may be summarized as follows:

1. Contrary to the prediction generated by our basic hypothesis, the religious group showed a significantly greater increase in "manifest anxiety" as a result of the questionnaire and interview procedures.

2. Both groups show increased negative affect toward death words on the word association task. The groups, however, do not differ from one another on this task.

3. The groups did not differ reliably from one another in the "semantic space" assigned to death words. Both tended to judge the concept "bad" and "potent". The religious group, on the activity factor, judged the death words to be "active" while the non-religious grup put these same words on the "passive" side of this factor.

Within this particular population (middle and high income level, high intelligence level, high educational level etc.) the evidence does not support the hypothesis that strong religious belief effectively reduces negative affect toward death. The evidence that does emerge suggests that religious and nonreligious people use different methods for binding their negative affect and anxiety toward death. The nonreligious subjects handle their affect by suppressing memories and feelings about death. The religious subjects handle their affect by denying the reality of physical death, focusing instead on the afterlife. In addition, it is postulated that the nonreligious person's defences are penetrated by minimal contact with death, while those of the religious person are penetrated only after dealing with the physical aspects of death.

The questionnaire and interview are analyzed for further evidence bearing on the hypothesis of differential defence against death affect. The findings from the questionnaire and interview support the notion that a theory which postulates that the two groups handle negative affect toward death with different defensive operations is tenable.

Finally, it is argued that the philosophers of religion and theologians are inaccurate when they state categorically that religion is able to dispel negative affect and anxiety aroused in man when he contemplates death. It is also suggested that psychological theorists have not recognized that religious and nonreligious people defend against the negative aspects of death in different ways.

Microfilm $2.05; Xerox $7.20. 155 pages.

PERMEABILITY AND COMPLEXITY: TWO DIMENSIONS OF COGNITIVE STRUCTURE AND THEIR RELATIONSHIP TO BEHAVIOR

(L. C. Card No. Mic 59-787)

Paul Raymond Binner, Ph.D.
University of Colorado, 1958

Supervisor: Assistant Professor Walter Mischel

This study was conceived within the framework of George Kelly's Psychology of Personal Constructs. It was concerned with two main problems: (1) testing certain theoretical deductions concerning the relationship between two dimensions of cognitive structure, namely, complexity and permeability, and behavioral effectivenss, and (2) investigating some of the characteristics of the permeability measure.

The instrument used for sampling cognitive structure was Kelly's Role Construct Repertory Test (REP Test). Complexity was defined in terms of how well the subjects differentiated among their constructs on the REP Test grid. Permeability was defined in terms of how often the subjects indicated that their constructs did not apply to one of the persons being construed on the REP Test. A check list of descriptive characteristics was also developed as an independent measure of permeability.

Our criteria of behavioral effectiveness were based on sociometric rankings performed by the subjects. Five of these rankings concerned behaviors involving interpersonal relations or skills concerning members of the opposite sex. Another five rankings were concerned with behaviors involving peer group members of the same sex. In each case, the subjects were asked to rank themselves and each other as to their relative effectiveness in each one of these behaviors. We also used a measure of social perception and a measure of halo effect as additional criteria of behavioral effectiveness.

In regard to the first problem, we failed to find any significant relationships between our measures of cognitive structure and various criteria of behavioral effectiveness.

In regard to the second problem we found: (1) evidence suggesting that our measure of cognitive permeability is reliable over both a short and a long period of time, (2) evidence suggesting that a permeability score obtained from one group of elements is positively related to a permeability score obtained from a similar group of elements, (3) evidence suggesting that permeability scores derived from dissimilar groups of elements are not significantly related, (4) no evidence supporting a significant relationship between permeability and grade point averages, and (5) no evidence supporting a significant relationship between different independent measures of permeability.

Our findings support the methodological soundness of a number of our procedures. We were also able to suggest a number of refinements of these procedures. The implications of the findings for the theory underlying the study were discussed.

Microfilm $2.55; Xerox $9.00. 196 pages.

AN INVESTIGATION INTO THE RELATIONSHIP BETWEEN THE RORSCHACH TEST AND THE FIRST DREAM IN THERAPY

(L. C. Card No. Mic 59-1011)

Gertrude Bondel, Ph.D.
New York University, 1958

Chairman: Professor Milton Schwebel

The purpose of this investigation was to study the relationship between the personality reflections of the individual as revealed in his perceptions in the Rorschach test and in the first dream which he brought to therapy. More specifically, it attempted to discover to what extent character traits, major conflict areas and defenses were congruent, similar and dissimilar in the Rorschach and first dream. It was hypothesized that both media might be found to offer essentially similar data in the specific areas under consideration.

The population for this study consisted of twenty-one patients in psychotherapeutic treatment at an outpatient clinic. They were of differing ages, both sexes, diverse educational attainment and of varying degrees and intensity of emotional illness. Subjects were chosen from among those patients in treatment for the first time, referred for psychological testing within a three months period from the onset of therapy and who brought a first dream to the therapist within this time limit. Patients were further selected from among those individuals who offered Rorschach protocol of the less neutral, more personalized type without the experimenter's prior knowledge of their dream material.

The procedure for this experiment was as follows: Twenty therapists recorded a verbatim account of the first dream and its associations, which new patients offered within the first three months of therapy. A Rorschach test was administered to those individuals and the protocols of the selectees identified according to code number, and the patient's age, sex, education, occupation and marital status. These Rorschachs were submitted for interpretation to two highly experienced clinical psychologists. The first dreams were similarly identified and sent to two highly experienced psychoanalysts for interpretation. Thus each Rorschach and each dream was evaluated twice. Four additional psychologists, post-doctoral trainees in psychotherapy, matched the Rorschach and dream interpretations which belonged to the same patient. The final raw data of the study consisted of a paired list of code numbers from each of the four judges.

A contingency coefficient (C) was obtained which measured the extent of the relationship between the dream and Rorschach material as evidenced by the number of correct matchings between the two. The maximum possible value for (C) in the present study was .71; the obtained value was .28. These results have failed to confirm the basic hypothesis. It may therefore be concluded in relation to the population utilized in the study, that the Rorschach test and first dream are not essentially similar.

This finding is in agreement with investigators Hall, Redmount and Mann, who were unable to establish essential commonality between the two sources of data. Schafer's observation that the dream and Rorschach differ to the extent that the latter uses secondary process type thinking may explain the basic difference between these media.

Inadequacies of the design of this study, which might have contributed to its outcome are: difficulties in the differentiation of a homogeneous population for matching purposes, insufficient evidence of the individual's dream life by the use of only one dream and inter-examiner differences in Rorschach and dream interpretations.

Microfilm $2.45; Xerox $8.60. 188 pages.

HOMELESS MEN, A PSYCHOLOGICAL AND MEDICAL SURVEY

(L. C. Card No. Mic 59-1253)

John Paterson Brantner, Ph.D.
University of Minnesota, 1958

A historical survey of vagrancy and homelessness, and a review of the related published work, including literary, religious, sociological, psychiatric and psychological works was presented. This revealed the existence throughout modern history of a special sub-group of homeless men. The subjects of this study were the non-resident, transient, casually laboring, unattached homeless men, historically and legally called vagabonds, rogues and vagrants.

This dissertation presented case record data drawn from 1622 consecutive admissions to the Minneapolis Salvation Army Men's Social Service Center, the results of 466 medical examinations, and the results of 296 Minnesota Multiphasic Personality Inventories.

The MMPI data showed clearly the importance in this group of that kind of psychopathology associated with scale 4 of that test. Over one-half of these men obtained scores on the Psychopathic Deviate scale two standard deviations or more above the normal mean, and nearly one-half had that scale as the highest scale in their profile. Scale 2 was next most prominent in their admission MMPI profiles; 27% had Depression scale scores two standard deviations or more above the normal mean. The mean MMPI profile for these men was 4'2789631--' (54)^{0}4.6.2. The psychiatric diagnostic groups that these men most resembled in their profile characteristics were Psychopathic Personality, Asocial, Amoral Type (Sociopathic Reaction, Asocial Type) and Psychopathic Personality, Mixed. They did not share MMPI code features in a noticeable degree with those diagnosed Schizophrenia, nor with those called Schizoid.

The case record data lent further support to the thesis of basic sociopathy in this group. As a group, they were vagrant, and many were life-long wanderers. One-half of these men had been in Minneapolis a week or less when they were interviewed. Two-thirds of them had no legal residence or settlement. They tended to drop out of school earlier than the rest of the male population. Their occupational levels were low, and their work was casual and intermittent. One-third were divorced and almost one-half never married. One-half of them had spent some time in penal institutions, as misdemeanants or felons. One-quarter of them had one or more tattoos. They drank excessively, but this appeared to be pathological, non-addictive drinking.

The medical data pointed to the same group characteristics. These men were very neglectful of personal

hygiene, and demonstrated medically that they had been living, eating, and sleeping irregularly, and that they had been drinking excessively. Tuberculosis rates and the incidence of venereal disease were significantly high. They did not show medical signs that they are subject to prolonged anxiety. They gave clear medical evidence of past fights, falls and comas. Three-quarters of the sample were physically fit for employment, yet they consistently spent considerable time in idleness.

Besides presenting descriptive data about the transient, mobile, homeless man, derived from case records, medical examinations, and MMPI's, this study also discussed the importance of Sociopathic personality characteristics in their adjustment.

Microfilm $2.70; Xerox $9.20. 205 pages.

A STUDY OF THE EFFECTS OF GROUP COUNSELING ON THE ACADEMIC PERFORMANCE AND MENTAL HEALTH OF UNDERACHIEVING GIFTED ADOLESCENTS

(L. C. Card No. Mic 59-482)

John Wesley Broedel, Ed.D.
University of Illinois, 1958

The purpose of the study was to investigate methods by which the outcomes of group counseling can be evaluated and to ascertain the extent to which group counseling improves the mental health and academic performance of gifted, adolescent underachievers.

The sample consisted of twenty-nine freshmen who were randomly selected from an operationally defined population of gifted underachievers in the eighth grade class of a large midwestern school system. The sample was divided into two experimental and two control groups.

At the beginning of the second grading period of their freshman year in high school, the experimental groups were provided a group counseling experience. The experimental subjects participated in sixteen group counseling sessions during an eight week period. No counseling or special assistance was given control subjects during this period.

The evaluation of group counseling was made on the basis of data obtained from five sources: (1) School grades; (2) The California Achievement Test Battery; (3) The Picture Story Test, a projective instrument assembled for the present study; (4) The Behavior Inventory; an instrument designed for the study which was used by a clinical observer and teacher-counselors who observed all group sessions by means of closed circuit television, the counselor of the groups, and parents to describe the behavior of experimental subjects; and (5) The Mooney Problem Check List. Although the regular high school form of the Mooney Problem Check List was used, the directions provided by the author were modified in this study. The evaluative instruments were administered the week prior to the first counseling session and readministered one and sixteen weeks subsequent to the close of counseling. Follow-up data for control subjects was not, however, available.

Statistical analysis indicated that group counseling per se did not result in improved academic performance as measured by school grades. In fact, group counseling initially may have negatively influenced school grades. Although very little change in the mean performance of experimental subjects on the California Achievement Battery was observed between pre- and posttesting, significant gains were made by the group between the posttesting period and the follow-up testing.

The experimental group made significantly greater gains between pre- and posttesting in acceptance of self and others than did the control group. This was demonstrated by the results of an analysis of Picture Story Test protocols by means of an objective scoring scheme. The behavioral descriptions made by significant others in response to the Behavior Inventory indicated that changes in the behavior of experimental subjects accompanied the changes in attitude revealed by the projective test. The descriptions of experimental subjects' behavior obtained after counseling from teacher-counselors, the clinical observer, the counselor of the groups and parents were more congruent with a pattern of behavior representing counseling psychologists' ideal of adjustment than were their precounseling descriptions.

Data obtained from self-reports in response to the Behavior Inventory did not reveal the occurrence of significant changes between pre- and follow-up testing in the group counseled students' perceptions of their own behavior. On the other hand, significant changes occurred for both experimental and control subjects in the way in which they reported their perceptions of their problems on the Modified Mooney Check List; therefore, it was not possible to arrive at conclusions concerning the effect of group counseling on clients' perceptions of their problems on the basis of the available data.

Microfilm $2.40; Xerox $8.40. 182 pages.

PERSONALITY IMPRESSIONS AND RESPONSE PREDICTION

(L. C. Card No. Mic 59-1255)

Alexander Bryan Caldwell, Ph.D.
University of Minnesota, 1958

Procedure

This thesis studied how accurately people could form brief, initial impressions of others. Accuracy was measured as the ability of the "percipients" (or judges) to predict MMPI item responses of strangers. The "targets" (persons whose responses were predicted) were chosen to be heterogeneous. Two groups of four targets each consisted of a college undergraduate normal, a currently hospitalized psychiatric patient, a severe alcoholic, and a man with a serious criminal record: these were their "experimental types". Four "data categories" of true information were used: these included age and sex in each instance, and three categories additionally included (a) education, occupation, and "experimental type", (b) eight family background items, and (c) the targets' verbatim responses to five "personal identification" items, such as "Name three books", "What are three things you very much enjoy doing?", etc. Targets, data categories, and four lists of 35 MMPI items were arranged into a 4x4x4 Latin Square, each percipient using a

different data category and different list on each of four targets.

One experiment used 48 high school students and the second used 120 college students, all in elementary psychology courses. In both the design was duplicated with half the groups observing the targets in common social activities; half were nonobservers. In the third experiment, a group of 24 nonobserving Trainee and Ph.D. clinical psychologists predicted the responses of the targets of the college experiment using the same data category information. In experiment four, 20 of the clinicians used each high school target's MMPI profile. Various ratings and percipients' self-responses were obtained.

Conclusions

1. Observation had no overall effect on accuracy.
2. In every experiment there was significant variation in the accuracy with which different targets were predicted.
3. Data significantly affected accuracy only in experiment 1. Accuracy from the age and sex only data category always exceeded the "experimental type" and family background categories where the percipients significantly overpredicted pathological responses.
4. Accuracy did not depend on similarity (overlap of target and percipient self-responses) nor on ratings of similarity. Accuracy depended very slightly on "Assumed Similarity".
5. Middle split items (near 50% true, 50% false for normal adult males) were used. Positive correlations up to +.62 showed that those who consistently predicted the majority response were more accurate than those who did not.
6. Trait ratings showed that particular information items, especially knowing the target's "experimental type", did induce impressions with considerable consistency among the percipients having that same target-data combination.
7. Correlations between the percipients' own expected (or guessed) accuracies and their obtained accuracies differed from zero by chance. Where expected accuracy varied widely and significantly, e.g. low when given age and sex only, and high when observing, the obtained accuracies were reversed or absent. Percipients differed widely in total expected accuracy (summed over four targets).
8. The F-ratios of inter-percipient variance (sum of obtained accuracy over four targets) over intra-percipient variance were small and of borderline significance. This plus the nonsignificant excess of clinician over college group accuracy would suggest that none of the percipients could be classed as consistently good or poor. Hence, in this context, neither such a talent nor similarity to the target group (4. above) would appear to be indicated as important variables in the selection of students for clinical programs.
9. On one of the four MMPI profiles, the clinicians showed an exceptional and consistent accuracy, well in excess of either the high school group using data items or the "base rates" accuracy. Various implications toward the training of clinicians were discussed along with the possible research methods in the validation of tests and of clinicians themselves as psychometric instruments.

Microfilm $2.05; Xerox $7.40. 156 pages.

AN INQUIRY INTO THE PREDICTABILITY OF ADJUSTMENT TO COMMUNITY LIVING FROM FIVE KNOWN FACTORS IN THE LIVES OF INSTITUTIONALIZED BOYS

(L. C. Card No. Mic 59-1013)

Richard Anthony D'Ambrosio, Ph.D.
New York University, 1958

Chairman: Associate Professor Howard M. Newburger

The purpose in this investigation is to determine the predictability of a man's adjustment or maladjustment to community living on the basis of five known factors in his life as an institutionalized boy.

The first aspect of the problem is to determine the relationship between each factor - age of institutional placement, educational achievement in reading, and in arithmetic, social maturity, personality adjustment - and his present adjustment to community living.

The second aspect combines the five factors and determines if, when taken together, they predict the boy's adjustment to community living as an adult.

Previous studies have demonstrated the adverse effects of early (infancy) institutional placement on the personality and subsequent adjustment of the child and adolescent.

The subjects in this study are ninety Catholic, unmarried men between the ages of eighteen and twenty-four and of lower economic status. Forty-five are now adjusted and forty-five maladjusted to community living. They were all previously institutionalized in either St. John's Home for Boys or St. Agnes' School, and were all later referred to St. Vincent's Home, from which they were discharged into the community between two and six years ago.

The material for the study is taken from the case histories and psychological test results of the men when they were boys in St. Vincent's Home. The tests are the Wide Range Achievement Test, the Vineland Social Maturity Scale, and the Rorschach.

To select the subjects, two social workers independently went through the files of the After Care Department of St. Vincent's Home and chose adjusted and maladjusted subjects in accordance with the study's definitions. The investigator made the final selection by keeping only those cases in which there was perfect agreement between the social workers, and where the subjects had been in the community between two and six years.

The results reveal that there is a significant relationship between three of the factors known about the boy and present adult adjustment to community living. The three significant factors are: age of institutional placement (.01 level), social maturity (.05 level), and personality adjustment (.05 level). Two factors are not significantly related. They are educational achievement in reading (.29 level) and in arithmetic (.29).

Discriminant analysis reveals that the five factors, taken as a whole, significantly differentiate the adjusted from the maladjusted group (.01 level).

An F-test for loss by elimination reveals that reading and arithmetic achievement do not contribute to the discriminatory power of the five factors and may be eliminated, resulting in a three-factor combination.

Weights and mean critical values are developed for

both a five-factor and a three-factor combination, to be used in two prediction equations. To use the three-factor equation, a new subject's age of institutional placement and scores on the other two factors are each multiplied by the weight of the factor. The result is a critical value. If this critical value is greater than 1.574627, then the prediction is one of adjustment. If the critical value is less, the prediction is one of post-institutional maladjustment.

The main application of the prediction equations is limited to residents of St. Vincent's Home until further research demonstrates their effectiveness in populations of other institutions.

The conclusions are that the adverse effects of early placement are constant through adolescence and early adulthood, are discernible in the social and personality maladjustment of the early-placed institutionalized adolescent and in the post-institutional maladjustment of the adult in the community.

Adjustment to community living is predictable on the basis of age of institutional placement, social maturity, and personality adjustment.

Microfilm $2.00; Xerox $5.00. 96 pages.

THE UTILITY OF THE MMPI ATLAS IN THE DERIVATION OF PERSONALITY DESCRIPTIONS

(L. C. Card No. Mic 59-1259)

Jan Duker, Ph.D.
University of Minnesota, 1958

Adviser: W. Schofield

The MMPI Atlas is a compilation of 968 case histories of psychiatric patients. The histories are indexed according to patients' coded MMPI profiles. The volume is used extensively in some clinical settings as a source of information about cases with similar MMPI profiles, while in other settings, it is used not at all. The present study was designed as a first step in evaluating the utility of the Atlas. Two major questions were investigated:

a. Can judges untrained in interpretation of the MMPI compile from appropriate Atlas case histories Q-sort descriptions of personalities of hospitalized psychiatric patients which will better predict a criterion than will stereotype sorts made by untrained judges from their preconceptions of the average patient?

b. Can personality descriptions compiled by untrained judges from Atlas case histories be refined by means of an averaging process so that, when the averaged descriptions are used as actuarial predictions, they will better predict a criterion than will descriptions made clinically by experts from MMPI profiles?

Testing the hypotheses which were formulated from these questions involved comparisons of the predictive accuracy of Q-sort personality descriptions compiled by: (a) untrained judges from their stereotypes of the average patient; (b) untrained judges from Atlas case histories; (c) MMPI experts from their stereotypes of the average patient; (d) MMPI experts from blind analysis of MMPI profiles. The criteria with which the descriptions from these sources were compared for accuracy of prediction were Q-sorts made by psychotherapists who described the personalities of patients with whom they had obtained at least ten hours of interview contact. Students enrolled in an introductory psychology course served as untrained judges while staff psychologists and trainees in clinical psychology at the Minneapolis VA Hospital where the criterion patients were hospitalized served as experts. The Q-pool was made up of ninety items drawn from the exhaustive compilation of descriptive statements about personality which is being developed at the University of Minnesota by the Ford Foundation Research Project on Diagnosis in Psychiatry. Items were screened by procedures designed to eliminate Barnum-effect items and to assure judgeability and test-retest reliability.

Among the conclusions supported by findings are:

a. Judges untrained in interpretation of the MMPI can compile from Atlas case histories Q-sort descriptions of personalities of hospitalized psychiatric patients which will correlate more highly with a criterion than will stereotype descriptions made by the same judges. In their Atlas-based descriptions, untrained judges show moderately high interjudge correlations and test-retest reliabilities.

b. Mean sorts derived from descriptions compiled from Atlas histories by untrained judges correlate as highly with criterion descriptions as do sorts made by experts from MMPI profiles. For some of the criterion patients, the Atlas-based sorts of every student judge excelled the description compiled by the expert whose sort correlated most poorly with the criterion. MMPI profile types differ in the accuracy with which their criterion descriptions can be predicted by experts and by student judges. Data suggest that accuracy is related to frequency of occurrence of the profile. Criterion correlations of descriptions compiled by students and by experts varied over a wide range. The best judge on one profile type was not necessarily the best on another profile type.

Findings of this study provide little justification for research and clinical neglect of the MMPI Atlas. It is an available device which the study suggests has considerable promise for increasing the effectiveness with which clinicians use the MMPI. Several suggestions were made for research directed to further evaluation and delineation of its utility and of the utility of similar compilations.

Microfilm $2.50; Xerox $8.60. 190 pages.

AN IDIODYNAMIC APPROACH TO EGO-DEFENSIVE BEHAVIOR: AN EXPERIMENTAL STUDY OF PERCEPTUAL, ASSOCIATIVE AND MEMORIAL REACTIONS TO AGGRESSION

(L. C. Card No. Mic 59-1345)

Jordan Edelman, Ph.D.
Washington University, 1958

Chairman: Saul Rosenzweig

The purpose of the present study was to investigate defensiveness as revealed in perceptual, associative and memorial aspects of behavior. An idiodynamic approach was utilized in terms of subject selection, stimuli selection, and data analysis.

On the basis of responses to the Rosenzweig Picture-Frustration Study, two groups of subjects were isolated:

a) an impunitive group made up of subjects who revealed a comparative inability to respond aggressively in the face of frustration and b) an extrapunitive group made up of subjects who demonstrated a comparative ease in expressing aggressive ideation in response to frustration.

Word lists were individually constructed for each subject and were composed of a) those words that were consistently rated as most agressive by a given subject and b) matched neutral words. These words were presented to the subjects in three experimental procedures designed to tap perceptual, associative and memorial aspects of behavior. The three procedures consisted of a tachistoscopic presentation of the stimuli, a word-association test and a recall test.

Hypotheses

1. The impunitive group will reveal significantly greater defensive behavior in the face of stimuli with hostile connotations than will the extrapunitive group.

2. Perceptual defense is not a unique phenomenon, but only one manifestation of a general defensiveness in response to threatening stimuli and, as such, it will be significantly related to defensiveness as revealed in the associative and memorial aspects of a subject's behavior.

3. The impunitive group will demonstrate significantly greater difficulty in coping with hostile stimuli than with neutral stimuli.

4. The extrapunitive group will demonstrate no difficulty in coping with hostile stimuli as compared to neutral stimuli.

The results of the between-group analysis indicated that the impunitive group demonstrated significantly more defensive behavior than did the extrapunitive group on all three experimental tasks. The impunitive group exhibited greater difficulty in a) identifying, b) making associations to, and c) recalling aggressive words (with reactions to neutral words serving as controls) than did the extrapunitive group.

The correlational analysis indicated that the three behavioral measures of defensiveness revealed significant intercorrelations and a significant over-all association, supporting the conception of defensiveness as a generalized phenomenon which has a pervasive effect upon behavior.

The results of the within-group analysis in respect to the perceptual and the memorial tasks ran counter to the predictions that had been made (as well as to the rest of the findings). The intrusion of two unanticipated extraneous factors--a) the development of a set toward aggressive words in the tachistoscopic presentation and b) the presence of a confusion factor affecting the capacity to recall aggressive words--was indicated. The effect of the set toward aggressive words was to lower threshholds for these stimuli; the effect of the confusion factor was to interfere with recall of the aggressive words. These factors, of course, played havoc with predictions made in respect to the way a given group would respond to aggressive as opposed to neutral words. They did not, however, distort the between-group analysis for they affected both groups. The differences between the groups, therefore, were still observable despite the intrusion of these factors. The weaknesses in design, which enabled the intrusion of these extraneous factors, were pointed out and improvements for future research were suggested.

Microfilm $2.00; Xerox $5.60. 114 pages.

PERSONALITY CHARACTERISTICS AND ACADEMIC ACHIEVEMENT IN SCHOOL OF ENGINEERING STUDENTS

(L. C. Card No. Mic 59-1266)

Arthur James Gallese, Jr., Ph.D.
University of Minnesota, 1958

A critical analysis of literature bearing on prediction of college achievement from MMPI data led to the conclusion that the role of the MMPI in academic prediction had not been clearly defined. Most previous studies were subject to criticism on the basis of inadequate sampling, failure to control relevent variables, lack of cross-validation information, or other methodological inadequacies.

In the present study the relationships between MMPI characteristics and academic achievement were studied in a sample of freshman engineering students. Normative MMPI data for these students was also provided.

Engineering students showed distinctive differences from general, male college students in having reliably lower mean scores on all clinical MMPI scales except Pa, and they obtained a reliably higher K score. Most marked differences were noted on Mf and Ma, thus suggesting that engineers tend to be more masculine in interests, less interested in people, and possibly less active and more stable in their behavior than general students. In addition, the engineers showed less depressive, pessimistic or anxious features. The mean profile of engineering students was intermediate between that of general students and the normal adult male profile, and showed no distinctive peaks.

In order to study those personality characteristics related to college achievement but not related to previous school achievement or scholastic aptitude, the effects of the latter characteristics were controlled by matching high and low achieving students in pairs on a measure of scholastic aptitude, predicted honor point ratio (PHPR). This variable, PHPR, was obtained from a regression equation employing high school rank probit (HSRP) and Cooperative Algebra Test (CAT) as predictors, and first quarter honor point ration (HPR) as criterion.

No consistent, reliable differences were obtained between the mean scores of high and low achievers on any MMPI scale. The mean Pa score of high achievers was higher than that of low achievers in one criterion sub-group, but not in a second criterion sub-group. No significant differences in means or sigmas on HPR were found between students with Pa as highest or second highest scale in their profiles and students without this characteristic.

The frequency with which the relative ranking of each MMPI scale paired with every other scale occurred in high and low achievers was investigated. No scale pairs were obtained which were characterized by having reliably more high achievers with the first scale of a pair ranked higher than the second scale and reliably more low achievers with the second scale of a pair ranked higher than the first scale.

No significant differences in means or sigmas on HPR were found between students with deviant MMPI profiles and students with normal profiles. However, the correlation between HPR and PHPR was lower for deviant profile students than for normal profile students, and the development of separate regression equations for the prediction

of HPR on deviant profile students and normal profile students failed to yield an increase in accuracy of prediction for either group.

An attempt to develop an achievement scale by item analysis of the MMPI yielded a scale with a significant beta weight when entered into a regression equation with CAT and HSRP for the prediction of HPR in the validation sample, but the scale did not hold up on cross-validation.

It was concluded that personality characteristics of engineering students, as reflected in MMPI scale elevations taken individually or in scale-pair combinations, bear no relationship to college achievement, and that personal adjustment as reflected in profile height is related to accuracy of prediction of achievement, but not to level of achievement.

Microfilm $2.00; Xerox $5.60. 113 pages.

RESPONSE DEVIANCY AS RELATED TO DEGREE OF SCHIZOPHRENIA, TEST AMBIGUITY, AND INSTRUCTIONS

(L. C. Card No. Mic 59-1390)

John William Giebink, Ph.D.
The University of Wisconsin, 1959

Supervisor: Assistant Professor Barclay Martin

A number of investigations have suggested that "response set" or "style" as differentiated from content is influential in determining test responses, but as yet few attempts have been made to systematically deal with this dimension.

In this study it was hypothesized that if response set were of real importance in determining test responses, it should be possible to test for it by evaluating the relationship between a particular test taking style and another variable thought to be related to the same trait. Previous work suggested that the tendency to make deviant responses was a response set worthy of investigation, and it was decided to test this response set against degree of schizophrenia. Response deviancy was defined in terms of making non-modal responses in making affective judgments ranging from "Like Much" to "Dislike Much" about nonsense syllables of high and low association value, meaningful words, and the geometrical designs of the Perceptual Reaction Test. Degree of schizophrenia was established by using one group of 28 normal subjects, one group of 28 intact schizophrenics, and one group of 28 disorganized schizophrenics. In addition test taking instructions were varied by having all subjects respond to the test stimuli according to their own personal preference in the first session, and by having one-half of each group respond in the manner in which they thought the average person would in the second session, which was two weeks later. Ambiguity was defined in terms of lack of response agreement, and was estimated in three different ways to evaluate its relationship to degree of behavioral disorganizations and instructions in regard to response set.

Response deviancy was measured by counting the number of non-modal responses, with the modal response for meaningful words and nonsense syllables based on the normative data of all subjects' first session performance, and with the modal response for designs of high and low ambiguity based on available normative data for the Perceptual Reaction Test. It was found that the tendency to respond deviantly had satisfactory reliability over time with reliability decreasing somewhat as a function of behavioral disorganization. The generality of the tendency, while it was enough so that the three groups consistently differed significantly in the same direction in number of deviant responses produced to all types of test content, was limited in that only small to moderate inter-test correlations were obtained between measures based on nonsense syllables and meaningful words, and meaningful words and designs, while there was no correlation between the measures based on nonsense syllables and meaningful words. Within groups the correlations among the various measures ranged from small negative ones to moderate positive ones.

The central hypothesis of the study, that the tendency to make deviant responses is related to degree of schizophrenia, received full support since the number of deviant responses increased as a function of behavioral disorganization. Two of the analyses also showed that there was a relationship between test ambiguity and behavior deviancy such that as ambiguity increased, the more normal the person, the greater his increase in deviant responses. Instructions to respond in the same way as normals did not act to lower the number of deviant responses, nor did they appear to be related to degree of schizophrenia or test ambiguity.

It was concluded that this study further establishes the importance of response set in test taking. While other implications of the study were discussed, it was thought that it is of primary importance that the general tendency to respond deviantly be considered whenever dealing with tests that have been devised to get at deviancy in a particular area of behavior.

Microfilm $2.00; Xerox $5.00. 97 pages.

A COMPARISON OF CHILDREN WITH CONGENITAL AND ACQUIRED ORTHOPEDIC HANDICAPS ON CERTAIN PERSONALITY CHARACTERISTICS: AN EVALUATION OF SELF-CONCEPT, ANXIETY, DEFENSE MECHANISMS, AND ADJUSTMENT IN CHILDREN WITH ORTHOPEDIC HANDICAPS

(L. C. Card No. Mic 59-1030)

James Kimmel, Ph.D.
New York University, 1958

Chairman: Professor Brian E. Tomlinson

The Problem

The purpose of this investigation was to study the relationship between the time in an individual's life when an orthopedic handicap occurs and certain personality characteristics. Children with congenital and children with acquired orthopedic handicaps were compared on lack of body confidence, lack of body esteem, lack of self assurance, the nature and intensity of anxiety experienced, defense mechanisms, and adjustment.

Methods and Procedure

The population of the study consisted of thirty children, of both sexes, between the ages of ten and sixteen, who were being treated for an orthopedic disability as outpatients at the Jewish Chronic Disease Hospital in Brooklyn, New York. Fifteen of these children (designated the congenital group) had a medical history which indicated that their orthopedic handicap occurred during or prior to birth. The other fifteen children (designated the acquired group) had a medical history which indicated that their orthopedic handicap occurred after they were five years old.

The congenital group and the acquired group were equated on age, sex, intelligence, and severity of orthopedic involvement.

Each child was administered the Figure Drawing Test and the Rorschach Test. Case study data from social casework reports were gathered on each child after completion of the test battery.

Lack of body confidence, lack of body esteem, lack of self assurance, and anxiety were measured from the figure drawings. Anxiety and defense mechanisms were measured from the Rorschach Test. Areas of adjustment difficulty were determined from the case study material.

Results

The Median Test and chi square were utilized to compare the congenital group and the acquired group on the personality variables.

The acquired group showed significantly greater body confidence and body esteem than did the congenital group.

The congenital group showed significantly greater instances of loss of control, inability to meet the situation adequately, feelings of insufficiency, and total anxiety indicators than did the acquired group.

The congenital group showed significantly greater use of projection as a defense mechanism than did the acquired group.

No significant differences were found between the congenital and acquired groups in regard to reported instances of adjustment difficulty in the areas of family, school, social relations, and attitude toward handicap and rehabilitation.

Duration of the disability and severity of orthopedic involvement were not found to be related to lack of body confidence or anxiety in either the congenital group or the acquired group.

No relationship was found, among the children with acquired handicaps, between age of onset of the disability and lack of body confidence or anxiety.

Among the children with congenital handicaps, those with cerebral palsy showed significantly greater use of flight from the self as a defense against anxiety and significantly more adjustment problems in regard to attitude toward the handicap and rehabilitation than did the non-cerebral palsy children.

Conclusions

On the basis of the findings in this study, it was concluded that:

The nature of the personality problems created by an orthopedic disability are related to the time in life when the handicap occurs.

Children with acquired orthopedic handicaps have greater confidence in and more esteem for their bodies, and can more adequately cope with anxiety than children with congenital orthopedic handicaps.

The findings were interpreted as supporting theories of personality development which emphasize the importance of motor maturation in the development of body confidence and ability to cope with anxiety.

Microfilm $2.00; Xerox $6.60. 138 pages.

THE EFFECTS OF EXAMINER ATTITUDES ON THE PROJECTIVE TEST RESPONSES OF CHILDREN: A STUDY OF THE SIGNIFICANCE OF THE INTERPERSONAL RELATIONSHIP IN THE PROJECTIVE TESTING OF CHILDREN

(L. C. Card No. Mic 59-1017)

William Karyle Lyles, Ph.D.
New York University, 1958

Chairman: Professor Avrum H. Ben-Avi

The purpose of this investigation was to determine the effects of variations in the attitudes of psychological examiners upon the responses of children to projective tests of personality.

The basic hypothesis underlying this investigation was that children would react to the attitudes assumed by examiners and that these attitudes would influence the responses of children to projective tests. It was hypothesized also that a positive attitude assumed by examiners would give rise to increased freedom of emotional expression, show of fundamental inclination in adaptation, and productiveness in the responses of children to these tests. It was hypothesized further that a negative attitude assumed by examiners would give rise to increased anxiety, aggression and oppositional tendencies, and effort to maintain emotional and intellectual control in the responses of children to projective tests.

Forty-eight normal, public school children, ranging between the ages of eight and one-half years and ten and one-half years - an equal number of boys and girls - were administered, by six experienced school psychologists, under three varying examiner attitudinal roles, the Rorschach Test and the Children's Apperception Test. The examiner attitudinal roles were characterized as positive, negative, and neutral. Both quantitative and qualitative analyses of the data yielded were made.

The nature of the responses on each of the tests, under the varying examiner attitudinal roles was determined. Differences were observed and evaluated as to their source by analysis of variance techniques.

Statistically significant F values were reported for the following Rorschach Test categories with the variance source examiner attitudinal role: W, D, FM, F, CF, FC, Hd, A, P, and R. To determine where the significance in the data exists, t tests were made of the differences among the role-groups. Significant t values were reported for the following categories: (1) positive-negative role-group: D, F, CF, FC, Hd, A, P, and R; (2) positive-neutral role-group: W, D, FM, F, CF, FC, A, P, and R; and (3) negative-neutral role-group: CF and FC.

Statistically significant F values were reported for each of the pictures of the Children's Apperception Test

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

with the exception of Pictures 1, 2, and 7 for differences in length of themes deriving from the examiner attitudinal role source. Significant t values were reported for the following pictures: (1) positive-negative role-group: Pictures 3, 4, 5, 6, 8, 9, and 10; (2) positive-neutral role-group: 3, 4, 5, 6, 7, 8, 9, and 10; and (3) negative-neutral role-group: none.

A 79 per cent level of accuracy was obtained by a panel of judges in "blind matching" of eighteen complete sets of test data with the examiner attitudinal role under which they were derived. Illustrative integrative analyses and protocols are presented along with discussions of the trends among them.

The results were analyzed as to their relationship to the basic hypotheses of the study. Judges applied the Personality Rating Scales to the test records for this purpose. Significant differences attributable to variations in examiner attitudinal role were reported.

The children reacted to the attitudes assumed by the examiners, and these attitudes influenced their responses to the projective tests. The positive attitude gave rise to increased productiveness on both of the tests. The positive attitude gave rise to increased show of fundamental inclination in adaptation on the Children's Apperception Test only. The negative attitude gave rise to increased anxiety and aggression and oppositional tendencies on both tests, but it did not influence the children's test responsiveness insofar as effort to maintain emotional and intellectual control is concerned to a significant degree.

Microfilm $3.00; Xerox $10.40. 232 pages.

AN INVESTIGATION OF SOME PERSONALITY CHARACTERISTICS OF EPILEPTIC AND PSYCHOSOMATIC PATIENTS: AN EVALUATION OF CERTAIN PERSONALITY MEASURES AND REACTIONS TO FRUSTRATION IN IDIOPATHIC EPILEPTIC, SYMPTOMATIC EPILEPTIC, AND PEPTIC ULCER PATIENTS

(L. C. Card No. Mic 59-1033)

Samuel J. Prensky, Ph.D.
New York University, 1958

Chairman: Professor Brian E. Tomlinson

The purpose of this experiment was to compare three groups, each with 26 hospitalized patients: idiopathic epileptics, symptomatic epileptics, and patients with peptic ulcer. All subjects were in-patients at the Veterans Administration Hospital, The Bronx, New York, between the ages of 18 and 44. The groups were equated for age and years of schooling. Factors which were constant in all groups were sex (male), color (white), and service in the armed forces. Two of the groups were believed to be similar with regard to the presence of psychological factors in the etiology of their illness. Thus, one group comprised men with peptic ulcers, and the other, men with idiopathic epilepsy. Two of the groups were identical with regard to their symptoms: both manifested grand mal seizures (symptomatic epilepsy and idiopathic epilepsy). The final pair of groups was similar in that both had verifiable physical lesions (peptic ulcers and symptomatic epileptics).

It was hypothesized that, with regard to measures of personality and reactions to frustration, the pair demonstrating the greatest similarity would be that with similar etiology (idiopathic epilepsy and peptic ulcer). The instruments employed were the Rorschach Psychodiagnostic Test and the Rosenzweig Picture-Frustration Study. The hypothesis was not confirmed with regard to the following aspects measured: Rorschach scores, ratios, and categories, Piotrowski CNS signs, Miale-Harrower-Erickson neurotic signs, or reactions to frustration as measured by the Rosenzweig Picture-Frustration Study. The hypothesis fared somewhat better with regard to the Piotrowski epileptic signs based on the Rorschach. That is, the group with symptomatic epilepsy demonstrated a greater frequency of these measures than either of the other groups. Thus, whereas 48 per cent of the group with symptomatic epilepsy demonstrated the presence of at least seven of the Piotrowski epileptic signs, only four per cent of each of the two groups in whom psychological factors played an etiological role, showed this number of signs. However, differentiation of the groups on the basis of a technique designed for that purpose does not necessarily indicate similarity between the remaining groups.

In summary, the hypothesis of greater similarity in personality structure between two groups with presumably similar etiologies was not confirmed. Several reasons, related to the composition of the groups and the techniques employed, were advanced to account for this negative finding. Various experiments were proposed to investigate the possible reasons for the failure of the hypothesis.

Microfilm $2.20; Xerox $7.80. 168 pages.

EXPLORATORY MEASUREMENTS OF THE PERCEPTUAL SPACE: A METHODOLOGY FOR INTERPERSONAL PERCEPTION ANALYSIS

(L. C. Card No. Mic 59-563)

Herbert Martin Rabin, Ph.D.
University of Illinois, 1958

An exploratory investigation of the individual's perceptual tendencies was conducted using Cronbach's proposed methodology for defining a person's perceptual space. For each S two generalized perceptual indices were obtained, viz., mean (M) and standard deviation (S.D.), for each trait or factored dimension on which others were judged. The Ms and S.D.s are said to be generalized because they describe the individual's general tendency to perceive others (objects) in certain ways.

A very heterogeneous group of ten objects was described by Ss in order to sample as much of the perceptual space as possible. The group of others consisted of mother, father, Joseph Stalin, Marilyn Monroe, Elvis Presley, Abraham Lincoln, a liked male teacher or employer, a disliked male teacher or employer, a friend of the same sex, and a friend of the opposite sex. Each of these others (and self) was rated on the same 36-item, five-point, adjectival scale.

Dimensions or traits were derived by factoring the items of the scale upon which others were judged. The orthogonal factors obtained were: I (Unhappy), II (Patient-Agreeable), III (Dependable), and IV (Adventurous).

Of the 80 Ss who participated, 40 constituted a "maladjusted" group and 40 an "adjusted" group. In each group there were 20 males and 20 females. The "maladjusted" Ss consisted of persons who voluntarily sought professional help for their emotional problems, mostly in outpatient facilities, while the "adjusted" group consisted of Ss who did not seek such help, and were not extremely anxious. In both the adjustment and sex subgroups the mean age was approximately 26, and the mean educational level was approximately one year of college.

Four exploratory hypotheses were investigated, with the following results.

1. With one exception, the M and the S.D. indices of the perceptual space were found to be moderately consistent attributes of the individual perceiver. This is a first step in demonstrating reliable individual differences in generalized perceptual tendencies.

2. Individuals who perceived others as widely (or narrowly) divergent on one trait tended to see others as divergent to a similar degree on other traits. The degree of generality over traits, however, was in part a function of the particular trait under consideration.

3. It was predicted that there would be statistically significant differences between the maladjusted and adjusted groups, and between men and women on Ms and S.D.s of the S's perception of others. While differences on the Ms were within chance limits, the average S.D.s of the maladjusted Ss were significantly larger than those of the adjusted Ss, and the average S.D.s of the women were significantly greater than those of the men. The direction of differences in S.D. was the same on each of the four traits for the adjustment and for the sex groups.

4. A final phase of the investigation focused on the individual's perception of a single object, self, within the framework of his perception of others. This approach to self-concept measurement did not differentiate adjustment and sex subgroups more efficiently than traditional self-concept measurement.

These findings suggest that Cronbach's proposed methodology may have considerable promise in the area of interpersonal perception. In the context of this exploratory research program, the statistically substantive findings are conceived of as promising hypotheses for future research. Microfilm $2.00; Xerox $3.00. 56 pages.

A COMPARISON OF ATTITUDES TOWARD CHILD REARING OF MOTHERS WHO DIFFER SIGNIFICANTLY IN SELF-CONCEPTS

(L. C. Card No. Mic 59-1020)

Avivah L. Sayres, Ph.D.
New York University, 1958

Chairman: Professor Brian E. Tomlinson

This study has involved an investigation into the relationship between self ideal-self discrepancy and parental-child attitudes. It was hypothesized that high and low self-acceptant mothers would differ significantly in child-rearing attitudes as related to self acceptance. It was further hypothesized that the highly discrepant mothers (those who evidenced a marked discrepancy between self- and ideal-self concept) would be more authoritarian, possessive, and rigid in attitudes toward child-rearing; and that the low discrepant mothers would evidence attitudes towards child-rearing which were in keeping with the variables of child-parent integration, permissiveness, and good judgment.

The population consisted of two groups, each comprised of eighteen mothers, who are residents of a suburban Long Island community, either in or near the village of Westbury. The Index of Adjustment and Values was employed to select the criterion groups on the basis of significantly differing self concepts. The following factors were equated for the criterion groups: Age, socio-economic status, educational level, and number of children. The mothers in both groups had no existing history of mental illness, institutionalization or participation in psycho-therapy.

A Parent-Attitude Questionnaire was administered to the criterion groups. This scale is a three part inventory consisting of thirty-six statements regarding child handling, twenty-five statements of child-handling practices, and ten stories describing a problem child followed by statements of possible ways of dealing with the problem. The questionnaire yields measures in the following areas: authoritarianism, permissiveness, rigidity-fussiness, child-parent integration and good judgment.

The data were subjected to appropriate statistical and qualitative analysis. The minimum criterion for statistical significance was the .05 per cent level of confidence. Fisher's F and "t" tests were utilized in the investigation of inter- and intra-group relationships between attitudes toward child-rearing and self concept discrepancy.

Findings

A comparison of the two criterion groups on the Parent-Attitude Questionnaire failed to reveal significant differences in child-rearing attitudes in any of the areas measured. The hypothesis that self- ideal-self concept discrepancy distinguishes between individuals or groups on the basis of child-rearing attitudes was not sustained.

Conclusions

Since no significant differences obtained between the criterion groups in terms of child-rearing attitudes, differentiated on the basis of self concept discrepancy, it was concluded that the variables of parental attitudes and self- ideal-self concept discrepancy are unrelated.

An inference was drawn from these results that normal populations may be significantly different from clinical populations and that conclusions derived from the study of clinical populations need not apply to normal or non-clinical populations.

Since this investigation dealt only with the verbalized attitudes of mothers, the need for further exploration on a deeper level of the relationship between self- ideal-self concept discrepancy and child-rearing attitudes was suggested. Microfilm $2.00; Xerox $6.40. 131 pages.

A MULTIDIMENSIONAL ANALYSIS OF THE BEHAVIOR OF HOSPITALIZED MENTAL PATIENTS

(L. C. Card No. Mic 58-5631)

Fred Werner Schmid, Ph.D.
University of Pittsburgh, 1958

Supervisor: John C. Flanagan

The development of satisfactory procedures for describing and classifying phenomena of psychopathology is one of the major unsolved problems of clinical science. Among both practitioners and research workers in the field, there is a wide spread belief that serious deficiencies are inherent in traditional clinical data language and classification systems.

A promising recent development in this area is seen in the increasing popularity of clinical rating scales for diagnostic and research purposes. While these scales in a number of ways represent an improvement over traditional diagnosis, it is also evident that they share some of its most serious deficiencies. Few, if any, of these instruments have been developed on the basis of an explicit rationale, and most of them require difficult judgments of generalization and inference on the part of the user.

The critical incident technique suggested itself as a method permitting the derivation of a sound empirical rationale for the development of a diagnostic instrument of the performance record type. It was hypothesized that for successful application, a performance record should require judgments less complex than does a rating scale, and therefore should be especially economical, objective, and discriminative in use.

As a preliminary test of this hypothesis, a critical incident study of the behavior of hospitalized mental patients was conducted. Using nursing staff as informants, 854 critical incidents of patients' behavior were collected at three psychiatric hospitals. This pool of critical incident data was categorized inductively. A total of 108 different types of behavior were identified and grouped into 14 behavior areas. The latter categories in turn were organized according to the three major headings of "Aggressive vs. Considerate Behavior", "Immature vs. Mature Behavior", and "Irrational vs. Rational Behavior".

The data were analyzed with respect to the applicability and economy of the technique used, and with respect to the logical consistency, reliability, and sensitivity of the classification derived. Findings were promising enough to justify the use of the classification as a basis for the development of a Critical Behavior Record on Mental Patients.

By means of this instrument, a second sample of 2972 critical incidents of the behavior of mental patients was collected. Again, nursing staff were used as informants. On each patient observed, two independent records, each covering a two-week period, were obtained. This new sample of data was used as a basis for cross-validating the results of the first study, and for assessing the adequacy of the performance record approach to the study of psychopathology.

It was found that the Critical Behavior Record was reasonably simple and economical in use. An evaluation of the relationship between individual items and behavior areas indicated the need for a regrouping of items. With respect to inter-observer agreement, promising results were obtained. In contrast to an earlier finding, behavior areas in this case were not related significantly to external variables (such as type of ward and duration of hospitalization).

It was pointed out that the latter finding did not necessarily constitute negative evidence for the adequacy of the performance record approach as such. Insufficient homogeneity of categories was considered likely to have been responsible for the absence of a significant relationship at least in part. A complete item analysis of the data was suggested as a procedure permitting the definition of more homogeneous categories, and a more conclusive demonstration of the diagnostic potential of the instrument.

Microfilm $2.40; Xerox $8.40. 182 pages.

SUCCESS OF PSYCHOTHERAPY AS A FUNCTION OF THE DISCREPANCY BETWEEN THE THERAPIST'S CONCEPTS OF PREFERRED AND ACTUAL CLIENTS

(L. C. Card No. Mic 59-1155)

Sarah Ann Segman, Ph.D.
Purdue University, 1958

Major Professor: Edith Weisskopf-Joelson

At the Purdue University Psychological Clinic, a study was carried out on the effect of the therapists' perception of their clients on the success of psychotherapy. It was hypothesized that the more similar to their ideal client the therapists judged their actual clients to be, the more likely therapeutic success. This hypothesis was drawn from literature cited in the study.

The 21 therapists were advanced graduate students of clinical psychology and the 35 clients were college students in therapy. Before therapists were assigned clients they described their preferred or ideal client by means of a test designed for this study. After assignment of clients, they described by means of the same statements what their actual clients were like. By comparing concepts of ideal and actual clients, a discrepancy measure was obtained. This therapist discrepancy score was viewed as an index of therapist satisfaction with their clients.

Indices of success of psychotherapy were derived from test data on the clients. These indices were increases in adjustment score (using Dymond's criterion) and lessened self-ideal discrepancy on the clients' posttherapy tests as compared to their pretherapy level of adjustment. Therapists and clients also evaluated therapy by means of the Nichols Rating Scales.

The results indicate there was no significant relationship between therapist discrepancy between ideal and actual clients and success. However, the distribution of scores suggested modifications of the original hypothesis. It appeared that when therapist discrepancy scores were very low, the lower they were, the more successful was therapy. When therapist discrepancy scores were very high, the higher they were the more successful was therapy. These unpredicted findings need confirmation by further study.

Other findings such as the effect on success of the

initial level of maladjustment of clients, the number of therapy sessions, and the experience of the therapists were presented. The more disturbed clients improved more. Therapist experience and the number of sessions had no significant relationship with success. Suggestions for further research were offered.

Microfilm $2.00; Xerox $4.80. 95 pages.

PERSONALITY AND DEVELOPMENTAL CHARACTERISTICS OF CHILDREN RATED MOST AND LEAST READY FOR FIRST GRADE BY THEIR KINDERGARTEN TEACHERS

(L. C. Card No. Mic 59-1042)

Gilbert M. Trachtman, Ph.D.
New York University, 1958

Chairman: Professor Brian E. Tomlinson

This study involved the evaluation of two groups of children rated most and least-ready for first grade, and a comparison of these groups in terms of certain personality and developmental characteristics. A Teacher Rating Scale was devised for the quantification of kindergarten teachers' judgments of first-grade readiness and all kindergarten children were rated by their teachers on this scale. The twenty-five highest and twenty-five lowest rated children meeting all delimitations comprised the most-ready and least-ready groups.

At the beginning of first grade initial status of each child was individually evaluated. Mental maturity was measured with the Stanford-Binet Intelligence Scale, physical maturity by means of height and weight measurements, motor development with the Bender Visual Motor Gestalt Test, emotional maturity with the Rorschach Test, and social maturity by means of the Vineland Social Maturity Scale.

At the end of first grade each child was evaluated for first-grade progress. Academic progress was measured by the Stanford Achievement Test and general developmental progress by the ratings of first-grade teachers using the New York Child Development Scales.

Results

The most-ready group was above average in physical, social, mental and motor maturity, with continued superiority in academic achievement and general developmental progress at the end of first grade. The least-ready group was also above average in physical maturity, and rated average in social, mental and motor maturity, but with mental maturity falling below local norms. These children, at the end of first grade, tended to fall below expected grade level in achievement and to be rated only average in general developmental progress. For both groups mental maturity and visual motor maturity were the most significant predictors of first-grade progress, with social maturity a close third in importance for the least-ready group.

Comparison of the two groups indicated no significant difference in chronological age, physical development or emotional maturity. Significant differences between the groups were found in mental maturity, visual motor maturity, social maturity, and in academic achievement and developmental progress.

Conclusions

It was concluded, from the above results, that kindergarten teachers, in judging readiness for first grade are capable of identifying children who are differentiable on psychological tests and measurements. Conversely, it was concluded that psychological tests and measurements are capable of differentiating children rated most and least-ready for first grade by kindergarten teachers. It was further concluded that kindergarten teachers, in judging readiness for first grade, are successful in predicting ultimate first-grade success. The judgments by kindergarten teachers of first-grade readiness are thereby proven to be valid. The results also indicated that kindergarten teachers, in judging readiness for first grade, seem to place great weight on the visual motor components of reading and writing readiness.

Most-ready children were found to possess certain personality and developmental characteristics in common, and may be characterized as indicating a constellation of above average mental, visual motor and social maturity. Least-ready children tend to possess certain personality and developmental characteristics in common, and may be characterized as indicating a constellation of below average mental, visual motor and social maturity.

The constellation of mental, visual motor and social maturity, as measured by specific psychological tests, successfully differentiated the most-ready from the least-ready group. Although this constellation successfully differentiated the two groups, it proved to have predictive value for first-grade progress only in identifying children for the least-ready group. Most-ready children would seem to be more diverse and varied in their growth and developmental patterns, and therefore less predictable.

Microfilm $2.50; Xerox $8.80. 191 pages.

PSYCHOLOGY, EXPERIMENTAL

AN INVESTIGATION OF RESPONSES TO INTRACRANIAL STIMULATION AND OF CORTICAL AND SUBCORTICAL WAVE FORMS IN THE ALBINO RAT

(L. C. Card No. Mic 59-465)

David Asdourian, Ph.D.
University of Illinois, 1958

Electrodes were chronically implanted into the brains of 20 male albino rats. Two of the electrodes came loose and these animals were discarded. A histological examination showed that 14 of the electrodes were in septal nuclei and 3 in the cortex. None of the animals with cortical electrodes pressed the bar in a Skinner box at a high rate for electrical stimulation between 70 and 90 microamps. Nine of the 14 animals with septal electrodes stimulated themselves at a high rate whereas 5 of the 14 animals responded at a low rate. Thus septal stimulation does not invariably result in high response rates. Five

of the high response animals showed a great deal of day to day variability. Three of the high response animals displayed convulsive behavior on a few occasions. There was no relationship between variability, convulsions, and the placement of the electrodes other than that all of the electrodes were in septal nuclei. The response rates of all the animals diminished within each of the 20 minute acquisition periods. This diminution of response rates during septal stimulation fits in with the satiation effects reported in the literature. No aversive behavior was detected in any of the animals although such behavior has been reported elsewhere.

Extinction was very rapid with the mean number of responses made by the experimental group falling to the level of the control group within the first extinction day. The extinction curve following self-stimulation might resemble the extinction curves following food and water reinforcement if a delay were introduced between the bar depression and the shock delivery.

The brain wave patterns did not show any relationship to electrode placement, response rate, water deprivation, or reinforcement with sucrose solution. The failure of the brain wave patterns to correlate with electrode placement conflicts with results by other investigators who found such a correlation, whereas the absence of correlation between wave patterns, sensory input, and motor movement is in agreement with one other study. Only in the present experiment were subcortical brain waves obtained from rats. Sporadic bursts of spike activity were recorded from almost all of the rats. Spike activity has been cited as an indicator for scar tissue, but spike activity has been obtained from the frontal lobes of humans whose clinical histories indicated freedom from brain damage. A cataloguing of brain potentials according to structure should be carried out by taking records before any stimulation work is done.

Microfilm $2.00; Xerox $5.60. 111 pages.

THE ROLE OF INCIDENTAL LEARNING AND STIMULUS GENERALIZATION IN ATTITUDE FORMATION

(L. C. Card No. Mic 59-754)

Constance P. Dent, Ph.D.
The Pennsylvania State University, 1958

The problem investigated in this research can be stated as follows: To determine whether negative attitudes (with which the clinician typically has to deal) have in some instances been formed because a person is predisposed to give a generalized negative response to a novel situation, person, or thing due to the presence within the stimulus complex (which the person, thing, or situation represents) of a stimulus element to which a negative response has been previously conditioned. Formally the three hypotheses to be investigated are as follows: 1) It is hypothesized that a stimulus element operationally distinguishable as a part of a stimulus complex, and yet not a part which an individual is consciously discriminating, can become effective as a component part of a stimulus complex in eliciting an autonomic response through the process of conditioning. 2) It is hypothesized that an autonomic response conditioned to an element of one stimulus complex will transfer to another stimulus complex of which the element is a part, providing that the element is also an operationally distinguishable part of the new stimulus complex. 3) It is hypothesized that the autonomic response caused by an unpleasant stimulus, and then transferred, will tend to create a negative attitude toward the new stimulus complex.

Forty-eight undergraduate male students were randomly assigned to a control and to an experimental group. Eight stimulus elements, each embedded in twelve different stimulus complexes (Hull's Chinese Figures), were presented to the subjects, and they were asked to try to assign the proper nonsense name to the stimulus complexes. The application of the correct name depended upon the subject's discriminating the certain fixed stimulus element within the changing stimulus complexes. Failure to name the figure correctly, therefore, meant that the subject was not able to discriminate the element consciously. The experimental group was shocked on alternate trials whenever four of the stimulus elements, each presentation being in a new stimulus complex, were shown to the subject. Trials in which an embedded element was not shocked represented a test trial for the presence of a conditioned GSR. Only the presence of a conditioned GSR to incorrectly named figures (figures in which the element was not consciously discriminated) were counted. Before and after this conditioning and testing process (which was continued for ten trials) the subjects were asked to put in order of preference eight stimulus complexes containing the eight stimulus elements used in the experiment. The control group was treated in exactly the same way as the experimental group except that no shock was administered.

The results confirmed the first two hypotheses at the 1 per cent level of confidence. An analysis of variance showed that the experimental group gave significantly (1 per cent level) more GSRs to incorrectly named non-shocked shock figures than did the control group. Experimental group subjects also gave significantly (.001 level) more GSRs to non-shocked shock figures than to non-shock figures. The latter result demonstrates that an autonomic response can be conditioned to a stimulus element of a stimulus complex, and the former result shows that this response can be generalized to a new stimulus complex in which the element is embedded.

The third hypothesis was confirmed also. The experimental group subjects ranked the figures containing embedded shock elements significantly lower (.05 level of confidence) on the ranking after conditioning than the control group. The subjects were not aware that only certain embedded elements had been shocked nor could they account for the more unfavorable ranking they assigned shocked figures after conditioning.

Implications of the findings in regard to attitude formation were discussed.

Microfilm $2.00; Xerox $4.40. 85 pages.

DRIVE LEVEL AND AMOUNT OF REINFORCEMENT AS VARIABLES AFFECTING THE ALTERNATION BEHAVIOR OF THE RAT

(L. C. Card Nol Mic 59-760)

Peter Vance Hanford, Ph.D.
The Pennsylvania State University, 1958

Variability is of considerable interest to the psychologist; one area studied by psychologists in their attempts to measure variability is alternation.

The present experiment was designed to measure alternation behavior under three levels of deprivation and three levels of reinforcement in two different mazes. A White-White maze was used to minimize, and a Black-White maze was used to maximize, the effects of stimulus satiation.

It was hypothesized that: 1) increases in drive level will bring about decreases in alternation, 2) increases in amount of reinforcement will result in increases in amount of alternation, 3) the greater the discriminability of the maze the higher the level of alternation.

Ninety-six male albino rats were assigned to one of seven treatments. Those treatments were: 0, 12 or 22 hours of food deprivation, with each of the 12 and 22 hour deprived groups divided into three levels of reinforcement. These levels of reinforcement consisted of: no reinforcement, .75 grams and two grams of wet mash. Half of the animals in each treatment were run in the White-White T maze and half in the Black-White T maze.

After the animals had been placed in individual cages and the different treatments randomly assigned, the animals were deprived according to the schedule to which they had been assigned. Each animal was then given two trials per day in a pretraining apparatus for a period of six days. In the experimental tests, given on the seventh day, the animals were given two trials in a T maze.

During the experimental trials, records were kept of the choice made. Once the animals had entered the goal arm of the maze a guillotine door was dropped behind them and the time for the three minutes in the goal box started. When the animals entered the goal box, a door at the entrance to the goal box was dropped and the animals were confined to the goal box for the remainder of the three minute period. At the end of the three minute period the animals were removed from the goal box, the guillotine doors raised and the animals placed back in the starting box for the second trial. On the second trial the choice was noted; if the animal alternated its response it was allowed to enter the goal box and eat the pellet of food. If the animal repeated its response, it was removed from the maze when it reached the goal box and returned to its home cage. No reinforcement was given if the animal repeated its response.

The results of the three levels of drive on alternation show an increase in alternation with increases in drive. The overall results for the Black-White maze which included the animals on the three levels of reinforcement showed a significant (.05 level) rise in alternation accompanying increases in drive level. The results of the White-White maze were in the same direction as the Black-White maze, but were not significant.

An analysis of the results of the three levels of reinforcement showed no significant change in alternation. The performance of the animals taken as groups showed individual trends; in the Black-White maze there was a consistent increase in alternation over the three levels of reinforcement while in White-White maze there was a consistent decline in alternation over the three levels of reinforcement.

A higher rate of alternation was noted in the White-White maze than in the Black-White maze. This lower rate of alternation in the Black-White maze was attributed to the avoidance of the white arm.

Microfilm $2.00; Xerox $3.60. 62 pages.

A MODEL OF HYPOTHESIS BEHAVIOR IN DISCRIMINATION LEARNING SET

(L. C. Card No. Mic 59-1397)

Marvin Levine, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor H. F. Harlow

A mathematical model of hypothesis behavior (defined as a specifiable pattern of response to a given stimulus set and exemplified by such patterns as stimulus preference, position alternation, and outcome contingent responses) in the discrimination learning-set experiment was described. This model permitted an analysis having these characteristics: (a) The operation of any reasonably large number of hypotheses could be analyzed simultaneously; (b) the relative strength of each hypothesis could be evaluated at successive stages of the experiment; (c) the measure of a given hypothesis would be uninfluenced by the presence of other hypotheses.

It was assumed that the hypotheses selected for analysis were mutually exclusive, that the set was exhaustive, and that the probability of occurrence of any hypothesis was independent of the position sequence of the stimuli. It was then proved that the strength, or probability, of $\underline{m}$ hypotheses could be found as the solutions of $\underline{m}$ equations which could be obtained from the raw data.

Analyzing several sets of data for the probabilities of as many as nine hypotheses yielded the following results: about 90% of the variance in a set of sequence-frequencies was explained by the model; conventional learning-set functions (e.g., per cent correct on trial two) could be synthesized by expected-value functions based on the hypothesis probabilities; the trends of various hypotheses could be followed throughout the course of a learning-set experiment. The last result showed that incorrect hypotheses do not extinguish at the same rate. For example, in one group of monkeys Position Preference was constant while Stimulus Preference decreased during 600 problems.

An experiment was performed according to a game theory paradigm wherein it was demonstrated that the hypotheses probabilities of the monkey are independent of the procedures employed by the experimenter, and that the difference in performance level for two different experimental procedures and for trials two and three are each a function of a single hypothesis.

Finally, an application of some of the concepts in the model was made to humans guessing coin tosses in which it was demonstrated that hitherto inexplicable results could in this way be explained. Microfilm $2.00; Xerox $5.40. 106 pages.

THE ROLE OF DISCRIMINATION IN ESTABLISHING A CONDITIONED DRIVE OF HUNGER

(L. C. Card No. Mic 59-766)

Lorraine A. Low, Ph.D.
The Pennsylvania State University, 1958

The study was designed to test a paradigm for the conditioning of a hunger drive. It was based on the notion that stimuli associated with reward acquire motivating properties, and that discrimination training was necessary to establish a conditioned hunger drive. It was predicted that animals who were given discrimination training would be more highly motivated when tested in the presence of the discriminative cue leading to food reward, than animals not given this training. It was also predicted that the difference in motivational level, as a result of this training, would be greater for those animals tested while satiated than for those animals tested while hungry. Rate of acquisition and level of performance on a new response, level of performance on a previously established response, and strength of a consummatory response were measures used to test motivational level. Appropriate controls were used so that any difference obtained could be attributed to differences in motivational level rather than habit strength.

Experiment I was replicated in Exp. II. In the latter experiment an attempt was made to eliminate agitated behavior present in satiated animals during testing in Exp. I.

The Ss used in the experiments were male albino rats of the Wistar strain, weighing approximately 250-350 gm. in Exp. I and 150-250 gm. in Exp. II.

The apparatus consisted essentially of three starting boxes, two goal boxes, and two feeding units, all made of wood. One starting box was painted with black-and-white stripes, the second, flat black, and the third, flat white. They were fitted with aluminum drop doors. The goal boxes were painted flat grey. They could be attached to the starting boxes so as to fit flush against the drop doors. Each feeding unit was partitioned into six identical feeding compartments similar in general appearance to the goal boxes. A wheel or a bar could be placed in any of the starting boxes. Downward pressure of the wheel or bar caused the door to drop. Pressure near the front wall of each starting box activated an electric timer. When the door dropped, the first timer stopped and activated a second timer. Removal of a rabbit pellet from a pellet-dispensing mechanism, present in the goal box, stopped the second timer. The latency of wheel-turning was the time from entrance into the starting box until the dropping of the door and the latency of pellet-removal was the time from the dropping of the door to removal of the pellet.

All animals were placed on a 22 hr. deprivation schedule. They were given pretraining trials running in the striped starting box, and pressing the bar in order to retrieve the pellet. The black and the white starting boxes with the bar present were used in training. The experimental group (E), the partial reinforcement control group (C-PR), and the continuous reinforcement control group (C-CR) were given half the daily trials from the white starting box and the other half from the black one. Group E was always reinforced when run from the white starting box, but never reinforced when run from the black one. Group C-PR was reinforced 50 per cent of the time when run from the black or white starting box. Group C-CR was always reinforced. The single stimulus control group (C-SS) was always run from the white starting box and always reinforced. The number of daily reinforced trials was kept constant for all groups. In Exp. II, Group C-CR was eliminated and all animals were given four interspersed days of satiated training trials in addition to the regular trials. For the test series, the animals were divided into hungry and satiated subgroups. The bar was replaced with the wheel, and the animals were always run from the white starting box and always reinforced.

The latencies of wheel-turning and pellet-removal were taken as measures on a new and previously established response. Number of pellets eaten was the consummatory response measure. There were no significant findings in the predicted direction on any of the response measures.

The procedure in Exp. II was not effective in eliminating agitated behavior. The presence of this behavior, errors due to the use of a mechanical system, imprecision in the experimental design, and crudity of the consummatory measures were factors which might have obscured any possible results. It was therefore concluded that a more precisely controlled experiment would yield a more accurate test of the present hypotheses.

Microfilm $2.00; Xerox $3.80. 67 pages.

THE EFFECTS OF SPACE PERCEPTION VARIABLES UPON PERFORMANCE

(L. C. Card No. Mic 59-1399)

Charles Douglas McDermid, Ph.D.
The University of Wisconsin, 1959

Supervisor: Karl U. Smith

This study investigated the process of structuring patterns of movement to the space dimensions of objects and surfaces which determine such movements. In order to observe this process, the space perception modalities of vision and kinesthesis were disrupted on the assumption that, from the process of rehabituation of motor patterns to perceptually distorted conditions, the principles of motor organization might be inferred.

Two distinct methods of disruption were employed: A) Closed-circuit television was used to distort the visual field. In this way the operator did not obtain a direct view of his performance, but rather observed a televised image of his movements in the monitor before him; by means of four combinations of inversion and reversal of this image, visually distorting conditions were experimentally manipulated for the purposes of this research. B) Task instructions requiring motor inversion of the normal patterns of handwriting were employed to distort kinesthetic feedback.

Seven groups of six subjects each performed for ten days, each group under a different combination of perceptually distorting conditions, three handwriting tasks varying in complexity. An eighth group served as a control, performing these same tasks, under normal perceptual conditions. Each group trained under a given set of perceptual conditions for nine days, then transferred to a different set on the tenth day of the experimental period.

Performance for all tasks was measured in terms of durations of contact and travel movements by means of high precision methods of motion analysis.

The results indicate that rapid adaptation to perceptually distorting conditions took place during the first four or five days of the experimental period, then levelled out in a pattern typical of motor learning. At the end of the ninth day, however, significant differences remained between the experimental and control groups, showing that complete rehabituation had not occurred. Travel movements recovered more quickly and more completely than contact movements during the training period. In general, the more perceptually complex the task, the more resistant was it to recovering to a normal level of performance.

Under the conditions of this research, it was found that kinesthetic distortion prolonged performance durations to a greater extent than visual distortion, both in the initial and in the recovery phase of the experiment. In both perceptual modalities, the degree of distortion also proved to be a significant factor.

The transfer data were generally positive, indicating that practice under one set of perceptually distorting conditions assists initial performance under a different set of perceptual conditions.

Specific hypotheses, formulated within the framework of the space-structured theory of motion, were experimentally evaluated in this study. The strong evidence adduced in support of these hypotheses points up the relevance of this theory to an adequate explanation of the development and organization of movement patterns. The relevance of a scientific understanding of these patterns to the applied aspects of work science was discussed.

Microfilm $2.00; Xerox $6,20. 129 pages.

AN EXPERIMENTAL INVESTIGATION OF THE RELATION OF SOME POSTURAL STATES TO LEARNING

(L. C. Card No. Mic 59-1032)

Frank D. Millman, Ph.D.
New York University, 1958

Chairman: Associate Professor Howard M. Newburger

The purpose of this investigation was to study the relation of some postural states to learning. It was hypothesized that the reclining posture would be negatively related, and the standing posture positively related, to learning performance in the laboratory situation. These hypotheses were based upon peripheralist theories concerning motor facilitation of central processes; experiments demonstrating a relationship between implicit muscular activity and mental imagery; and studies revealing beneficial effects upon learning performance and mental work of moderate increases in muscular tension. The problem of postural relations to mental function has but rarely, and only in very limited fashion, been previously investigated.

Sixty male college students, approximately equated on the basis of sex, age range, immediate memory span, and minimal educational level, were randomly assigned to four experimental groups consisting of fifteen subjects each. The four groups differed from each other only in sequence or order of postures in which learning performance was tested. Four postures were tested: sitting, standing, reclining, and an activity posture consisting of pacing back and forth within a circumscribed area. The learning material consisted of one practice and four experimental lists of six three-place consonant nonsense syllables which were to be learned by the familiar anticipation-recall method of learning adapted to an auditory presentation.

The learning material was pre-recorded on record discs and reproduced on a record-player which was moved close to the subject each time he assumed a new posture. Utilizing a Graeco-Latin square design, postures, sequences, and learning lists were all randomized so that they were orthogonal, or independent, of each other.

A statistical analysis of the experimental results revealed that the differences between postures was highly significant. However, most of the variation contributing to significant differences between the postures could be attributed to the activity posture which was negatively related to learning. There were no significant differences between sitting, standing, and reclining.

Three sub-groups of "good" learners, "poor" learners, and "average" learners were drawn from the experimental population for separate statistical analysis to investigate whether these three groups differed from the total experimental population and from each other in the relation between the four postural states and learning.

There were no significant differences between any of the postures for the group of "good" learners or for the group of "poor" learners, but the differences between postures was significant for the group of "average" learners. An analysis of the orthogonal contrasts for the between postures sum of squares for the group of "average" learners revealed that most of the variation contributing to the significant differences between postures for this group could be attributed to the activity posture, which was inhibitory to learning for these subjects.

The investigator's hypotheses were not supported by the experimental results.

An analysis of the experimental results and of the interview data obtained from subjects suggests that individual differences in learning experiences, habit formation, and educational training seemed to be major influences affecting individual responses to the postures rather than innate differences between the postures in degree and magnitude of muscular contraction and innervation.

Microfilm $2.80; Xerox $9.80. 216 pages.

AN INVESTIGATION OF SOME CONDITIONS UNDERLYING THE LEARNING OF SUBLIMINALLY PRESENTED STIMULI

(L. C. Card No. Mic 59-1349)

John Moore Nolte, Ph.D.
Washington University, 1958

Chairman: Carl E. Sherrick

A number of investigators have reported studies in which they found positive evidence of the perception of subliminal stimuli. A question has been raised, however,

as to the adequacy of the criteria that were used to determine the threshold values in these studies. In view of this criticism, the results of previous investigations are equivocal, and subliminal perception cannot be considered as adequately demonstrated.

The present study represented an attempt to investigate further the effects of subliminally presented stimuli. In order to avoid some of the criticisms made of other studies, and to extend the implications of this study, the discrimination required of the subjects was imbedded in a learning task which was presented at various stimulus values within the threshold range. The stimulus dimension by which threshold values were determined was exposure time, and two other variables previously related to the study of subliminal perception were included in a factorial design. The three variables investigated were: Exposure time, association value of the stimuli, and the number of presentations.

The procedure consisted of establishing a phi-gamma function for each subject by a modified Method of Constant Stimuli, following which a paired-associate learning task consisting of either High- or Low-Association-Value nonsense syllables was presented for either 20 or 40 trials at one of three exposure levels: Subliminal, Liminal, or Supraliminal. The subject then learned another task presented by a memory drum. This task consisted of the same pairs of stimuli previously presented combined with an equated set of new or control stimuli. A savings score was calculated by comparing the number of trials the subject required to reach a criterion for each of the two sets of stimuli.

An analysis of variance performed on the savings scores revealed that the only factor yielding a significant F-ratio was Exposure Time, and a significant savings score occurred only at the supraliminal exposure level. While interpretation of this analysis would be that liminal and subliminal presentation of the learning task did not affect the later learning of the same stimuli, certain trends and consistencies in the data suggested a further analysis in terms of transfer of training. This analysis suggested that there was transfer at all three exposure levels. The transfer was found to be both positive and negative, depending upon the combination of factors, and was interpreted in terms of transfer as a function of the degree to which the initial task had been learned. While this interpretation was ad hoc, and did not therefore afford conclusive evidence, the results suggested that further investigation would reveal learning at subliminal and liminal exposure levels as well as at the supraliminal exposure level.

A further finding was a difference in threshold values as a function of association value. As hypothesized, threshold values for syllables of high association value were lower than threshold values for syllables of low association value. This finding was interpreted on the basis of the frequency of occurrence of letters and combinations of letters in the English language.

Microfilm $2.00; Xerox $4.40. 83 pages.

QUANTITATIVE ANALYSIS OF MOTOR COORDINATION BY MEANS OF SCIENTIFIC TECHNIQUES OF MOTION ANALYSIS

(L. C. Card No. Mic 59-1401)

Eugene Richard Oetting, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Karl U. Smith

This study is part of a series of experiments concerned with the experimental analysis of human motion, aimed at increasing our knowledge of human motion in applied work science, and the development of a theoretical foundation of behavior. In the investigation, two new relative measures of motor coordination are operationally defined in terms of the ratio and correlation of the durations of component movements in patterned motion. In the experimental part of the work, significant variations in these special new measures of motor coordination are investigated in relation to learning and different experimental conditions of stress. In addition, the relative reliability of the different measures is also evaluated in different ways.

Two separate experiments are run; one using noise and glare as conditions of mild psychological stress, the other using severe alcohol intoxication to produce a deficiency in motor performance. The subjects perform a simple handwriting task, writing the letter "g" ten times in a row. Electronic methods of behavior recording and motion analysis make possible measurement of a manipulative time, or time in forming the letters, and a travel time, or time of movements to the next letter.

Results may be stated as follows: There are considerable practice effects in the mean times and variabilities of both components. These occur primarily in early trials.

Mild psychological stress over this short work period does not cause a deficit in performance. Noise and glare lead to a reduced travel variability with no change in the mean travel time.

Severe alcohol intoxication leads to greatly increased manipulative and travel variabilities, and some increase in manipulative and travel means. The correlation between the components of the motion pattern remains remarkably consistent between the sober and intoxicated conditions.

Manipulative and travel means are highly reliable, even with a modest number of scores entering into their computation. Variability measures and the correlation score require a fairly large number of scores to obtain reliable estimates. The correlation between the components can be measured reliably and seems to be relatively independent of any of the other measures of performance.

The ratio between the means reflects the interaction of the components to some extent, but closer analysis suggests that the ratio is not very useful, and that the information it gives could be obtained more efficiently through other measures.

The correlation score, on the other hand, appears to measure to some extent the individual subjects integration of the manipulative and travel components of motion into a functional pattern. The results of the study indicate the possibility of adding a new dimension to the study of behavior through the study of motor coordination by obtaining correlational measures between the movement components. Microfilm $2.00; Xerox $5.80. 116 pages.

FOOD-MAINTAINED BEHAVIOR IN THE MONKEY FOLLOWING BILATERAL ABLATION OF THE AMYGDALOID COMPLEX

(L. C. Card No. Mic 59-1451)

Jerome Seymour Schwartzbaum, Ph.D.
Stanford University, 1959

Experiment 1

The experiment was designed to explore the role of the amygdaloid complex in motivational processes concerned with hunger drive and the reinforcing properties of foods. Eight rhesus monkeys were trained to press a lever so as to obtain periodically a food reward. Four of the animals received bilateral lesions of the amygdaloid complex, while the others underwent a sham operation. Bar-pressing behavior was studied postoperatively under various conditions of deprivation and "satiation," and, independently, with different magnitudes of reward.

Amygdalectomy did not alter bar-pressing activity under uniform conditions of deprivation (24-hours) and reward (1/2 gm pellet). Effects were obtained when either one of these conditions was manipulated.

Amygdaloid operates were less responsive than were normal animals to prolonged periods of food deprivation (70-hours) where the deprivation was preceded by corresponding periods of ad libitum feeding. The operates showed much less of an increase in bar-pressing. At the same time, they consumed more food during the initial ad libitum feeding than did the normals and maintained a higher level of body weight. Reliable differences were not found for the reduction in bar-pressing activity following the ad libitum feedings.

Amygdaloid operates were also less responsive than were normal animals to an increase or a decrease in the magnitude of food reward. The operates showed less of an increase in activity for a reward of three 1/2 gm pellets, and they did not exhibit satiation-type decrements in performance during terminal parts of these test sessions. Similarly, they did not react as strongly as did the normals in terms of reduced output to a decrease in magnitude of reward from three 1/2 gm pellets to a 45 mg pellet.

The adaptation to altered reinforcing conditions was further examined by alternating extinction sessions with the regularly reinforced sessions. This procedure resulted in a depression of the reinforced behavior of the normal animals but not in the performance of the operates. Extinction of bar-pressing was not affected by the lesion.

It was concluded that amygdalectomy impairs satiation mechanisms concerned with the regulation of food intake, and that the hyperphagic effects are not associated with a generally increased level of hunger. The data did not indicate to what extent the reduced sensitivity of the amygdaloid operates to prolonged deprivation relates to their level of body weight.

The effects which were obtained with the changes in reinforcing conditions appeared to involve a common factor wherein one set of reinforcing events influenced the response to some other set of reinforcing events. It was postulated that amygdalectomy reduced the extent to which the animal responded to one set of stimuli in relation to other sets of stimuli. This disturbance in generalization was assumed to apply both to reinforcing stimuli and to discriminative stimuli.

Experiment 2

The experiment provided further data on bar-pressing behavior of amygdalectomized animals following changes in reinforcing conditions. The changes were associated with a stimulus that was presented for a brief period once during each session. Test conditions in the absence of the stimulus, which involved periodic reinforcement with a 45 mg reward, remained invariant. Eight monkeys that were used in the first experiment served as subjects.

The conditioning of an increase in rate of response to the stimulus when it was paired with a larger (two 1/2 gm pellets) or otherwise more preferred reward (two peanuts) was not impaired by the lesion. Similarly, the extinction of the incremental response over a block of sessions was unaffected by the ablation. However, the extinction appeared to be responsible in the normal animals for an increased magnitude of response on reconditioning when compared to conditioning. This facilitory phenomenon was not evident in the performance of the amygdaloid operates.

In so far as the reconditioning performance involved an interaction between dissimilar reinforcing conditions, the results appeared to confirm and extend the findings of the first study. The absence of any impairment on the conditioning was related to the differences in conditions from the first experiment, and suggested some of the variables that might relate critically to the appearance of lesion effects.

Microfilm $2.10; Xerox $7.40. 159 pages.

THE FORM OF THE CURVE OF MEMORY IN ROTE LEARNING

(Publication No. 21,507)

George Conrad Seeck, Ph.D.
University of Michigan, 1934

This dissertation belongs under the general heading of "Association". Extensive work by a number of investigators has left open the questions (1) as to the form of memory curves, (2) why the curves took the form they had, and (3) the stability of the form of the curves.

The Glaze list of nonsense syllables was used, and they were limited to serial and paired orders. The fifteen subjects were psychology students at the University of Michigan. Making use of the "anticipation" method the learning was first recorded, then graphed for each sitting. The Kjerstad method of plotting was adopted.

The first experiment was on the form of the curve for serial learning. A total of two hundred seventy-six lists were obtained.

The second experiment made use of paired materials. The task was to anticipate the second members of pairs. One hundred twelve lists were learned.

The third experiment used paired syllables, but the presented order was constructed as to association value of syllables. The first list was "easiest", the second "harder", the third next "harder", the fourth was "hardest". These lists were contrasted with lists of a balanced association value.

The fourth experiment was a return to serial learning, but with the lists constructed similarily to experiment three.

The fifth experiment was designed to obtain introspective reports from trained subjects who were interrupted to report on what they knew of the lists in process of learning.

The sixth experiment again used paired syllables, but the pairs appeared in four different orders.

A final minor experiment was made with one subject learning six lists of syllables in serial order. The lists were either predominantly "hard" or "easy", presented in a variable order.

The results show that the curve for serially presented materials begins as almost a straight line; but some negative acceleration begins at about 50% of the learning time. With paired presentations, there was a small positive acceleration during the first 30% of learning time and negative acceleration began at about 50% of learning time.

With trained subjects, the stability of the curve of either serial or paired syllable presentation is not materially changed by introduction of variously calibrated sections. A list of "easy" syllables does not yield a different curve than one of "hard" syllables. In general, the "S" shaped curve was not found except for a suggestion, and that only with paired syllables.

Whenever there is failure to rearrouse a specific response which worked correctly on the last preceding trial, this phenomenon is called a change from success to failure. Such changes are more frequent, in proportion to the number of "bonds" involved, with serial than with paired material--especially in the early part of the curve. With both serial and paired material, changes from success to failure occur most frequently in the region of 40% to 85% of the learning time.

Microfilm $2.65; Xerox $9.20. 202 pages. Mic 59-1930.

SPONTANEOUS ELECTROCORTICAL ACTIVITY AS A PREDICTOR OF ADAPTATION TO STRESS

(L. C. Card No. Mic 59-1117)

Stanley Samuel Starkman, Ph.D.
George Peabody College for Teachers, 1958

Major Professor: Julius Seeman

The purpose of this study was to test hypotheses derived from a principle formulated from evidence regarding spontaneous electrocortical activity of alpha frequencies.

The evidence included stability of the alpha pattern, blocking and reoccurrence of alpha following continuous or repeated stimulus presentations, and the relation of alpha to anxiety. It was assumed that the underlying unity within the above evidence was best represented by the concept of homeostasis.

The principle is as follows: Spontaneous electrocortical activity of alpha frequencies occurring under conditions of minimal external stimulation is an index of physiological stability, or adaptation to stress.

From the principle the following hypotheses were derived: Ss with the highest percentages of alpha will show the greatest degree of physiological stability, as measured by increases in GSR conductance within a given time, during which stress was introduced.

Ss with the greatest percentage of prestimulus alpha waves will show the longest latency in onset of blocking and/or the greatest rapidity in reoccurrence of alpha during stimulus presentations.

The percentage of prestimulating alpha will be inversely related to amplitude of psychogalvanic (GSR) deflection resulting from the presentation of a stimulus.

The sample consisted of 57 students in introductory psychology courses at George Peabody College and Vanderbilt University.

The experiment consisted of three consecutive phases. In the first phase both GSR and electroencephalographic (EEG) records were obtained under quiescent conditions. In the second phase both instruments recorded while a noise stimulus was presented ten times at thirty second intervals. The third phase was identical to the first.

Results and Conclusions

The first phase EEG records were correlated with GSR log conductance change occurring within a given time during the stimulus phase. The results indicated a significant correlation between percentage of prestimulus alpha and rate of adaptation. The relationship was not linear. Eta = .89. The .05 level of significance was used in all statistical tests.

There was no correlation between prestimulus alpha and loss in alpha occurring during the stimulus period, or between prestimulus alpha and amplitude of GSR deflection. It was concluded that latency of blocking and/or reoccurrence of alpha was not related to rate of adaptation, and that intensity of reaction, measured by GSR deflection, was not related to GSR rate of adaptation.

The EEG measure was found to be stable, r = .97, when prestimulus and poststimulus records were correlated. The stability of the GSR measure was questionable, r = .53, although a significant degree of association was found between prestimulus and poststimulus records.

In general the data supported the principle, although whether there was a consistent rate of adaptation, necessary for the principle to have generality, was questionable. A greater than chance occurrence of lower GSR resistance increases in the poststimulus phase suggested that the time between presentation of the last stimulus and initial poststimulus GSR recording had artificially attenuated GSR stability. Further study of this question was proposed.

Microfilm $2.00; Xerox $5.60. 112 pages.

EXPERIMENTALLY INDUCED CHANGES IN IMPRESSIONS OF PHYSIOGNOMY AND PERSONALITY

(L. C. Card No. Mic 58-5183)

Thomas Michael Stritch, Ph.D.
Emory University, 1954

The present study was designed to determine the effects of single psysiognomic trait changes upon the perceptual organization underlying physiognomic and personality judgments of photographs. Within this design the question of whether personality judgments are associated with behaviorally validated traits was completely ignored.

Approaching physiognomy as a problem in social perception, the study attempted to determine the effects of systematic variation in single physiognomic traits upon two types of judgments or impressions. Within this general framework, answers were sought for the following specific questions:

1. What is the effect of single physiognomic trait changes upon the physiognomic judgments of photographs?
2. What is the effect of such changes upon the personality judgments of photographs?
3. If there is an association between the physiognomic and personality traits attributed to photographs, are the effects of single physiognomic trait variation related to this association?

In addition to these exploratory questions, a number of specific hypothesis were checked:

1. When a salient trait is altered by the artist, perceptual changes will occur primarily in other salient traits, not in peripheral traits.
2. When a peripheral trait is changed by the artist, perceptual changes will occur primarily in other peripheral traits, not in salient traits.
3. Artist-produced changes in physiognomic traits will induce more perceptual changes in photographs with low physiognomic eccentricity than in photographs with high physiognomic eccentricity.
4. Eccentricity in physiognomy is associated with eccentricity in personality. Eccentricity was defined as the extent to which a photograph is rated as having outstanding or deviant traits.

A number of photographs were secured by photographing employees of local business firms in Atlanta, Georgia. Fifty of these pictures, revealing only the head and face, were then shown to groups of college students who were asked to rate each picture on 18 physiognomic traits. Eccentricity indices were then computed for each photograph. On the basis of these indices, 24 pictures were selected for use in the remainder of the study. Of the 24 selected, eight had high eccentricity indices, eight had medium eccentricity indices, and eight had low eccentricity indices.

Nine physiognomic traits which could be varied by an artist and which were relevant to personality impressions were chosen for variation. Three pictures, one having a high, one a medium, and one a low eccentricity index, were varied on each of the nine physiognomic traits. Three degrees of physiognomic trait variation were produced in each picture by an artist retouching identical prints. Different groups of judges then made physiognomic and personality ratings for the photographs.

An analysis of the personality ratings demonstrated that systematic variation in single physiognomic traits had no systematic effect upon the personality impressions obtained from the photographs. The analysis of physiognomic ratings demonstrated that systematic variation in single physiognomic traits induced many perceptual changes in other physiognomic traits. A cluster analysis was performed upon the personality trait ratings to demonstrate the association between impressions of personality and impressions of physiognomy. This analysis produced six clusters of pictures which were similar with respect to personality impressions.

Two analyses of variance showed that the physiognomic-personality configurations of these clusters were significantly different from one another. Variation of a single physiognomic trait salient to a given cluster induced changes primarily in other salient physiognomic traits, whereas variation of a physiognomic trait which was peripheral to a cluster induced changes in traits which were also peripheral to the cluster. No relationship between physiognomic and personality eccentricity was demonstrated on the basis of the obtained data.

The data provided no overall explanation for the direction of induced changes in physiognomic judgments. The presence of these changes as a result of variation in single physiognomic traits was interpreted as evidence for the existence of learned physiognomic configurations. The induced changes in physiognomic traits was viewed in terms of a perceptual reorganization, necessitated by the unrealistic photographs produced by changing only one physiognomic trait.

The finding that variation in single physiognomic traits apparently produces no stable or systematic changes in personality impressions was regarded as evidence that physiognomy is not singly related to personality judgments.

The demonstration of an association between personality and physiognomic impressions was regarded as indicative of a generalized relationship which operates in judgments of photographs of human faces. The fact that alterations in physiognomic traits salient to a pattern of personality impressions induced changes primarily in other salient traits whereas alterations in peripheral traits induced perceptual changes primarily in other peripheral traits suggests that physiognomic judgments are not independent of personality impressions. The mechanism underlying this apparent dependence upon personality judgments was interpreted in terms of transfer of perceptual habits rather than a direct dependence of one set of impressions upon the other. These results were discussed in terms of the existence of strong social stereotypes.

The failure to demonstrate a relationship between physiognomic eccentricity and personality eccentricity was attributed to the difficulties encountered in identifying and measuring adequately physiognomic variables which might be relevant for personality impressions, and to the limited meaning of physiognomic eccentricity.

The data suggested the following tentative conclusions regarding judgments of photographs of human faces:

1. Variation in single physiognomic traits induces a perceptual reorganization of physiognomic impressions manifested by perceived changes in other physiognomic impressions.
2. Variation in single physiognomic traits produces no stable systematic changes in personality impressions, thus suggesting a relationship based upon interaction rather than a one to one association between physiognomic and personality impressions.
3. There is a demonstrable association between the physiognomic and personality traits attributed to photographs. The effects of variation in single physiognomic traits seems related to this association.
4. When a salient trait is altered, perceptual changes occur primarily in other salient traits and
5. when a peripheral trait is altered, perceptual changes occur primarily in other peripheral traits.

Microfilm $2.00; Xerox $4.60. 86 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE EFFECTS OF MASSED AND SPACED ELECTROCONVULSIVE SHOCK ON CONFLICT BEHAVIOR IN THE MALE ALBINO RAT

(L. C. Card No. Mic 58-3791)

Gertrude Joanne Williams, Ph.D.
Washington University, 1958

Chairman: Dr. John A. Stern

Brady and associates have demonstrated that a series of electroshock convulsions attenuated a classically conditioned emotional response. In addition, they have called attention to a concurrent "paradoxical" increase in such instances of unlearned emotional behavior as resistance to handling and hyperirritability. More recently, Stern and associates have demonstrated quantitatively that a series of convulsions enhances unlearned emotional responses. The purpose of the current investigation was: 1) to test the hypothesis that a series of electroshock convulsions attenuates learned emotional responses and concurrently enhances unlearned emotional responses; 2) to determine whether some of Brady's findings for a relatively simple classically conditioned emotional response could be generalized to a more complex, instrumentally conditioned emotional response pattern (i.e. conflict); 3) to test the hypothesis that spaced convulsions exert more striking effects than massed convulsions on both categories of emotional behavior.

One hundred forty-nine male albino rats under water deprivation were divided into two major groups after suitable "warm-up" trials on a straight alley runway to water in the goalbox. During training trials, one major group, the conflict-trained group, had to traverse the now electrified grid of the runway in order to attain its daily water ration in the goalbox. The other major group, the untrained group, was merely placed directly into the goalbox for its comparable daily exposure to the runway. After eight training trials, each major group was subdivided into five groups respectively. These treatment groups were given two variations in the length of the interval between convulsions as well as two variations in the length of the pre-ECS interval. Three measures of learned emotional behavior and two measures of unlearned emotional behavior constituted the dependent variables of the experiment. The data were subjected to Mann-Whitney "U" Test analysis.

The following conclusions were drawn from the current investigation:

1) A series of electroshock convulsions increases unlearned emotional behavior. Increases in such diffuse behavior patterns are more pronounced and of longer duration among animals given spaced convulsions than those given massed convulsions.

2) A series of electroshock convulsions attenuates specific patterns of learned emotional behavior providing that the time interval between the last conflict-training trial and the first convulsion is of relatively short duration.

a. If the interval between the last training trial and the first convulsion is of relatively long duration, then the learned emotional responses are not attenuated.

b. Spacing of the convulsions results in more striking attenuation of the learned emotional responses than the massing of convulsions.

c. Post-ECS extinction trials do not result in the later reappearance of the learned emotional responses; the emotional responses are still attenuated during retesting trials fifty-one days later.

3) The work of other investigators has suggested that the attenuation of conditioned emotional responses may have been an artifact by virtue of the possible confounding of the effects of emotional training and the effects of the convulsions. The finding of attenuation of the instrumentally conditioned conflict response in the current investigation cannot be interpreted as an artifact. Considerable preliminary experimentation resulted in the selection of two separate categories of emotion, learned and unlearned emotional behavior. In view of the fact that two categories of emotion were used, the divergent effects of the convulsions on two separate response categories was not paradoxical.

It was suggested that the enhancement of unlearned emotional behavior referred to increased responsiveness to a wider variety of environmental stimuli on the part of the experimental animals as compared to the control animals. On the other hand, learned emotional behavior may have been attenuated because the impact of the emotion-inducing stimuli associated with training had been minimized relative to the hyperreactivity induced by electroconvulsive shock.

Microfilm $2.00; Xerox $6.00. 124 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

DOUBT IN THE LIFE AND THOUGHT OF PASCAL

(L. C. Card No. Mic 58-3096)

Donald Luverne Colburn, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor William G. T. Douglas

The purpose of this dissertation is to examine the place of doubt in the life and thought of Blaise Pascal. In this study doubt has been defined as the absence of a definite conclusion in support of or in opposition to an idea -- an attitude of suspended judgment emerging from a questioning, critical perspective. This attitude has been examined in the context of two foci: life and thought. Life has referred to those events, responses and reflections which have influenced or emerged from doubt. Thought as it has been used in this study has emphasized Pascal's formal statements about doubt, particularly in his discussion of the doubt of others in the Pensees.

The procedure has been to present and evaluate those experiences in the life of Pascal which encouraged an attitude of doubt. The following influences were found to be significant; the age in which he lived; family influences; scientific interests; education; physical illnesses; experiences of the world; philosophical interests; and religion and the church. Similarities and differences in the doubt expressed in science, philosophy, and religion have been discussed, and an attempt has been made to relate Pascal's experiences of doubt in these areas to any formal thoughts he recorded about them.

This examination has revealed a continuity in Pascal's doubt as it has been expressed in science, philosophy and religion. The attitude of doubt has played a significant role as Pascal progressed through these areas of thought and experience, and resolved itself finally in his submission to Christ. Pascal's discussion of doubt in the lives of others in the Pensees was influenced by his own experience of doubt. The solution to doubt which he proposed in this writing was the one which he had experienced in his own life.

Summarized, the conclusions of this study are as follows:

1. Pascal was greatly influenced by the age of doubt in which he lived.
2. Pascal's physical frailty and his unusual intellectual ability predisposed him to a life of reflective, critical thinking and doubt. This predisposition was fostered by an isolated education and an intellectually competitive home atmosphere.
3. As a youth, Pascal was trained in science. The rigid discipline of this method encouraged an attitude of doubt in science as well as in other areas of thought.
4. The worldly period in Pascal's life made an important contribution to his understanding of the problem of doubt. Though this was the period in which he expressed the greatest indifference to religious matters, he did not seriously question at any time the existence of God.
5. As the result of his second conversion, Pascal found the certainty which he had been seeking in his life and which he had not found previously in science or in philosophy. His projected Apology for the Christian Religion, which in its unfinished state exists today as the Pensees, was an out-growth of this conversion experience. In this work he severely criticized the libertines or free thinkers of his day. His discussion of the problem of doubt in the religious life -- its motivations and its solutions -- represents a significant contribution to our heritage of apologetic literature in the Christian tradition.

Microfilm $3.10; Xerox $10.60. 238 pages.

THE NATURE OF HUMAN EXISTENCE: A COMPARATIVE STUDY OF THE DOCTRINE OF MAN AS FOUND IN REINHOLD NIEBUHR AND SRI AUROBINDO

(L. C. Card No. Mic 59-1702)

Arnold Dudley Hunt, Ph.D.
The Hartford Seminary Foundation, 1959

The purpose of this study is to compare two views of man and his destiny, the general background of the study being the meeting of Christian and Vedantic thought, not only in India but also in various ways in the West. A leading Christian theologian and an eminent Indian philosopher have been chosen as representative of the two traditions.

Chapter I is introductory. Niebuhr's early liberalism is outlined and later influences on his thought are sketched. Aurobindo's education, his early political activity and his withdrawal as philosopher and yogin are described. Aurobindo sees his philosophy as integrating the insights of East and West.

Chapter II is a summary of Niebuhr's anthropology designed to provide a base for further study. The controlling concept is the self's freedom which determines his epistemology, his view of sin and his ethics.

Chapter III is a similar summary of Aurobindo's view of man. The controlling concept is that of man's identity with Brahman. The One is manifest in the Many. By involution and evolution Brahman is present in and becomes realized in the Many. Supramental knowledge is awareness of oneness instead of duality and, with that knowledge, discord is banished.

Chapter IV discusses man's predicament. Egoism has its roots for Niebuhr in the self's existence in finiteness and freedom. For Aurobindo it lies in his ignorance of Brahman. For Niebuhr it is inevitable but not necessary, a view which is examined. For Aurobindo it is a concomitant of particular selfhood which may be transcended.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Chapter V deals first with the role of reason. For Aurobindo man must rise above mind to supermind. For Niebuhr some "faith" is prior to reason and we contend that this is true of Aurobindo. The question arises as to whether the latter's faith, his integralism, adequately comprehends man's total experience. Then the nature of the Divine revelation is considered with a comparison of the concept of avatāra and that of Incarnation.

Chapter VI deals with the nature of liberation (Aurobindo) or redemption (Niebuhr). The yogic ascent is described. Against this is set Niebuhr's view of salvation as the result of God's action in Christ. The gnostic life is a life above individuality. For Niebuhr salvation is the fulfilment of man's freedom. The adequacy of Niebuhr's stress on grace as forgiveness rather than on forgiveness and power is questioned.

Chapter VII is concerned with the "new" man and society. Action in the gnostic life is free of egoism. For Niebuhr love is the ultimate norm which finds expression in the attempt to establish justice. It is contended that Aurobindo's vision of a race of supermen can give little guidance to life in society now.

Chapter VIII sets out Aurobindo's evolutionary philosophy of history and is followed by Niebuhr's exposition of the eschatalogical symbols of the end, according to which no completion of history is possible save by the power of God. Ultimately time is transcended for Aurobindo. For Niebuhr eternity fulfills but does not annul time. The thesis closes with a concluding statement on the meeting of Christian and non-Christian.

Microfilm $3.55; Xerox $12.00. 273 pages.

CHRISTIAN REDEMPTION IN THE THEOLOGY OF NELS FREDERICK SOLOMON FERRÉ: COMPARED WITH AULÉN, BRUNNER AND DEWOLF

(L. C. Card No. Mic 58-3120)

Jacob Sackmann, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor L. Harold DeWolf

Both the problem and methodology of the dissertation follow this pattern: (1) a presentation of Ferré's views regarding redemption, (2) comparisons with the other three selected theologians, (3) an ordered summary of Ferré's relative theological position. This summary appears in chapter eight and briefly notes some similarities and dissimilarities among the other three theologians.

Chapter two presents the term redemption and its correlatives as used in standard Protestant reference works. This determines the areas treated in chapters three through seven.

The study includes these conclusions: (1) Knowledge of God as agape is limited to God's revelatory work made known in Jesus Christ in Ferré's, as in Aulén's and Brunner's writings. DeWolf adds theistic evidences. (2) God as being is uncaused and unconditioned but He becomes by creation and by redemptive personal relations with men for Ferré as for DeWolf. God's being is self-sufficient, with creation, preservation and redemption optional self-giving activities in Aulén's and Brunner's writings. For Aulén this is a paradox. Brunner concludes that God acts to realize His glory. (3) An essential but unfulfilled image within man awaits maturing experiences and Divine-human encounter in Ferré's and DeWolf's writings. Brunner emphasizes God's sole initiative so that maturing experiences seem to be negated. Aulén paradoxically asserts that man is essentially opposed to God yet chooses opposition. Paradoxically reconciliation depends upon God's subduing activity, yet upon man's "yes." (4) Jesus Christ is understood as truly God and truly man by Ferré as by Aulen and Brunner. The latter two do not, like Ferré, explain the Incarnation by perichoresis. DeWolf asserts that God's will and purpose were perfectly Incarnate in the human Jesus. Ferré has a distinct emphasis concerning the repeatability of the Incarnations, and concerning the Trinity. (5) At-one-ment in Ferré's distinct view is based upon perichoreses. All four theologians conclude that at-one-ment is offered to all men in Jesus Christ. Aulén's distinct view emphasizes fusion of wrath and love within God. (6) Personal depth repentance results in a reconciled relationship with God and fellowmen in Ferré's writings as in those of the other three theologians. The image within leads to such repentance for Ferré as for DeWolf. Paradoxically, for Aulén man's "yes" is indispensable yet all depends upon God's subduing activity. Brunner sees all human seeking as egocentric and doomed to frustration. Thus, Divine-human encounter, solely initiated by God, alone, leads to repentance and reconciliation. (7) Saints are nurtured by prayer, worship and witnessing. They are not free from sin but can partially demonstrate victorious love and power over sin in Ferré's writings as in the writings of the other men. Ferré, like DeWolf, makes more enthusiastic assertions of victory. Perichoresis offers a distince emphasis upon potential victory, for Ferré. Aulén and Brunner see sin so subtly involved in all man's doings that victory is less a possession than a hope. (8) Ferré distinguishes between the Church and the churches as do the other men in some manner. The two Protestant Sacraments are emphasized. Aulén gives a distinct emphasis to the institutional form of the Church and Sacraments. Christian cells etc., are enthusiastically advocated by Ferré, DeWolf and Brunner. (9) Death is seen as God's final frustration of self-security. Resurrection means a conscious post-historical existence for Ferré as for the other three theologians. Ferré makes a distinct reference to purgatory. However, all four assert redemptive final judgment with Ferré and Brunner asserting universalism. Ferré, like DeWolf, asserts more optimistic views of social betterment but with Aulén and Brunner asserts a cosmic consummation. (10) Ferré's mediating efforts to reformulate theological truths indicate the possibility of an ecumenical theology.

Microfilm $4.85; Xerox $16.20. 378 pages.

THE CHURCH'S OPPORTUNITY FOR THE RELIGIOUS EDUCATION OF CHILDREN FROM BIRTH THROUGH FIVE YEARS OF AGE

(L. C. Card No. Mic 59-1703)

William Perroneau Tolley, Ed.R.D.
The Hartford Seminary Foundation, 1958

The purpose of this thesis is threefold: (1) to consider the opportunity and responsibility of the Christian Fellowship for guiding the child in his religious development. (2) To examine (a) the needs of the child and their effect upon his religious development; (b) the effect of parents, teachers and other adults upon the child's religious development. (3) To study the obligation of the Church to provide adult leadership and the educational environment equipped to lead the child through the satisfaction of his basic needs in growth toward Christian maturity.

In the introductory chapter the writer discusses (A) The Church's Attitude toward the Religious Education of Children, (B) Infant Baptism and (C) The Development of The Church School and its Curricular Materials. This discussion is background for understanding the present attitudes and practices of the Church toward the child.

Chapter II is concerned with the place of the child in the Christian Fellowship. It discusses the nature and unity of the Christian Fellowship and the role of persons as related to the child's religious development.

Chapter III is concerned with the attitudes and practices of Christian parents in the home and their effects upon the child's own religious development. It discusses the importance of good family relationships to the child's religious development.

In Chapter IV some church school curricular materials of the Lutheran, Presbyterian, Congregational, Episcopalian and Unitarian churches are examined. The religious concepts and attitudes and the needs and interests of children are set forth as the materials suggest. The organization of the material as to its practical help for parents and teachers is also considered. After an objective analysis of each group of materials there follows a section of critical comments on the materials.

The thesis concludes that: (1) The child's level of growth and development does not warrant an emphasis upon instruction, memorization or catechetical instruction in the Scriptures or beliefs of the Church. (2) The real approach to a child's religious development is through an understanding of his needs, experiences and capacities. This necessitates an understanding of the importance of play as a period in which the child expresses his needs and plays out his experiences in order to establish his place in the world. (3) The child's experiences with nature and his relationships with people lay the foundations for growth toward God as Creator and the God of love. (4) The relationship of love between child and parent and child and teacher is prerequisite to the life of worship. (5) The faith, attitudes and practices of parents and teachers affect the child's religious development. Parents and teachers need guidance in understanding the Bible, the Christian faith and the way people grow and develop. They need an understanding of these things in order to be capable of guiding the child's own religious development. Microfilm $3.20; Xerox $11.00. 247 pages.

DETERMINANTS OF VERBAL COMMONALITY AND INFLUENCIBILITY

(L. C. Card No. Mic 59-1261)

Danuta Ehrlich, Ph.D.
University of Minnesota, 1958

Adviser: Dr. Stanley Schachter

An experimental study was conducted dealing with the relations of certain individual difference variables to influencibility. Its primary purpose was to evaluate two alternative formulations of verbal commonality, i.e., motivational and experiential, verbal commonality being measured by the frequency of normatively common word associates in responses on the Kent-Rosanoff word list. It was assumed that if verbal commonality is chiefly motivationally determined, high commonality individuals should be more invluencible than low commonality individuals and the difference between them should be more apparent in a public than in a private condition. If, however experiential factors are the crucial ones, the two groups should behave similarly under both conditions and, at the same time, they should differ on a variety of experiential factors.

The investigation was also intended to examine the degree to which level of outside social participation and ordinal position in family account for influencibility. Simultaneously, the second problem entailed a test of a conceptual scheme of influencibility in which conformity was postulated to be largely a joint positive function of two clusters of motives: "fear of rejection" and "dependence." the first construct being coordinated to the variable social participation and the second to the sibling order variable.

To study the above issues, data were obtained from 134 male college students preselected on the commonality continuum who met in groups of six. The major part of the experiment involved securing two judgments, one "quick" and one "well-considered," from each subject about an ambiguous situation. Individual fictitious reports, designed to make each subject perceive himself a deviate, were interpolated between the first and the second judgment. The change between the first and the second

judgment gave the measure of incluencibility. Ratings of confidence in judgments were also obtained. Half of the groups were run in the private condition, the other half in the public condition. In addition, subjects provided information about their background, extent of social experiences and social participation.

The major results for the verbal commonality issue were as follows:

The experimental data did not give any support to the motivational formulation of commonality. No differences in influencibility were found between high and low commonality. No differences in influencibility were found between high and low commonality subjects in either the private or the public condition. The results suggested, however, greater variability of responses among the low commonality subjects.

A distinct pattern of larger means and, in most cases, of significantly larger variances were noted for the low commonality subjects on the items tapping range of experiences and social contacts (eg. time in new surroundings, membership in organizations). These findings together with the experimental results were viewed as consistent with the experiential formulation of verbal commonality.

With reference to social participation and ordinal position variables, these were the findings:

The data suggested that influencibility was partly a function of outside social participation. High participators, as classified on a three-item social participation index, tended, by and large, to be less influencible than low social participators (p=.07). This relationship was somewhat clearer in the private than in the public condition. Using a purer measure of social acceptance, i.e., whether organizational offices were or were not held, the overall relationship emerged much more impressively (p=.02).

Taken all together, the first and only children appeared more influencible than the later siblings (p=.06). The relationship was highly significant in the private condition (p=.02) and only barely manifest in the public condition. Whereas first and only children conformed about as often under both conditions, later-borns changed toward the group significantly more often under the public than under the private manipulation (p=.04). An explanation of the differential condition effects in the two sibling groups was ventured.

The seeming relevance of social participation and ordinal position for the determination of influencibility were viewed as corroborative of the proposed conceptual scheme of influencibility.

Microfilm $2.00; Xerox $6.00. 124 pages.

THE INCIDENCE OF HOSPITALIZED MENTAL DISORDER AMONG RELIGIOUS SISTERS IN THE UNITED STATES: 1956

(L. C. Card No. Mic 59-903)

Sister Mary Kelley, I.H.M., Ph.D.
St. Louis University, 1958

The information of this study was obtained by means of a mailed questionnaire which was sent to 378 public and private hospitals with psychiatric facilities. Three hundred and fifty-seven hospitals (94.4 per cent) submitted usable responses to the questionnaires which included present age, age at hospitalization, age at entrance into convent, history of previous hospitalization for mental illness, occupation prior to hospitalization, and diagnosis.

A total of 783 sisters were reported as having been hospitalized for mental illness at some time during 1956. This represented a significant increase over the corresponding rate reported by Thomas Verner Moore in 1936. Although incidence of mental disorder is still lower among sisters than among women in the general population, it is increasing more rapidly among the former than among the latter. This increase has been restricted to sisters engaged in active and professional work. The rate of mental illness among cloistered sisters is still considerably higher than among active religious, but the difference between the two groups has decreased greatly since 1936.

Among active religious, those engaged in domestic service show a rate of hospitalized mental disorder which is notably greater than among those whose tasks are professional in nature. Functional psychotic disorders are most numerous in both groups, but they are proportionately more numerous among domestic workers, whereas the less severe psychoneurotic reactions predominate among teachers and nurses.

The findings of this study by no means nullify Moore's earlier hypothesis that prepsychotic personalities may be attracted to religious life on the basis of what they think it will be. The apparent increase in mental disorder among active religious, however, suggests that factors of stress may be contributing more to eventual breakdowns than was previously supposed.

Microfilm $2.30; Xerox $8.00. 175 pages.

THE EFFECT OF TWO SITUATIONAL FACTORS ON CONFORMITY BEHAVIOR

(L. C. Card No. Mic 59-554)

Edward Robert Ostrander, Ph.D.
University of Illinois, 1958

In recent years there has been increasing interest in the influence of the group upon individual behavior. Some researchers have investigated situational factors while others studied personality correlates of conformity behavior. Relatively little work has been done involving the interaction of personality and situational factors.

This study focuses on the situational factors of positive and negative reinforcement and anonymity or identity of the subject as well as the personality dimension of ascendance-submission.

One hundred and twenty-five male undergraduates enrolled in General Psychology at the University of Illinois constituted the experimental sample. To provide a measure of ascendance-submission the AS Reaction Study was administered to these subjects in large groups.

At later meetings groups of five subjects were told that they were participating in an experiment on the perception and judgment of stimuli. Subjects sat in individual booths facing a wall upon which the stimuli to be judged were projected. At the front of each booth was a panel of lights and a set of switches. These lights indicated to the subject the order in which he was to make his judgment as a member of the group. In addition the lights supposedly conveyed the judgment made by the other four members of the group. Subjects registered their judgment of each stimuli by throwing the appropriate switch. On trials which were used to determine an individual's conformity score, he was directed to make his judgment following the other four members of the group. A subject conformed when his answer agreed with those of the other four group members, but was not the correct answer. The judgments which appeared on a subject's panel were predetermined answers fed into the subjects' panels by the experimenter. Stimuli judged included both perceptual items such as line lengths and factual items such as the chief exports from various countries.

The experimental conditions included a positively reinforced-identified group; a positively reinforced-anonymous group; a negatively reinforced-identified group; and a negatively reinforced-anonymous group. The reinforcement variation was manipulated in the following manner: a positively reinforced group was told upon completion of a preliminary series of judgments that they had judged more accurately than a norm group of college students. The negatively reinforced subjects were told that their judgments in the preliminary series had been less accurate than the norm group's. The other situational variation, identity-anonymity, required identified subjects to write their answers on a signed answer sheet as well as throwing the switch to indicate their choice of a response. Anonymous subjects merely indicated their answers by throwing the switch with the understanding that no other subjects knew of their choice.

Hypotheses predicted that submissive subjects exposed to either negative reinforcement or the identified conditions would exhibit more conformity behavior than submissive subjects under positive reinforcement or anonymity. Other hypotheses stated that ascendant subjects under these same conditions would not differ in conformity behavior. Finally it was hypothesized that under conditions of negative reinforcement or identification submissive subjects would show greater conformity than ascendant subjects exposed to the same experimental conditions.

The hypotheses were not confirmed with one exception. There was significantly more conformity by negatively reinforced submissive subjects than by positively reinforced submissives. Since several hypotheses were tested, a single significant outcome must be interpreted with caution since it may be due to chance factors.

The possible methodological difficulties such as low reliability of the conformity test, sophistication of subjects and ineffectiveness of experimental directions were discussed. A brief appraisal of the theoretical models used in experimental studies of conformity behavior was made. Microfilm $2.00; Xerox $5.60. 113 pages.

ACADEMIC ACHIEVEMENT ATTITUDES IN GROUP PERCEPTION IN SIXTH GRADERS

(L. C. Card No. Mic 59-559)

Lorene Childs Quay, Ph.D.
University of Illinois, 1958

Studies of conformity to group norms have tended to be concerned with the individuals' reactions to the objective group norm--that is, the norm as perceived by the experimenter. However, others have been concerned with the members' perceptions of the group norm. Although many factors, both individual and group, have been related to conformity, one important factor which has been shown to be related to conformity is attraction to the group (liking).

Newcomb's theory encompasses both perceived attitudes and liking in the explanation of conformity behavior. It was postulated that person A's attitude toward object X and his attitude toward person B are interdependent. Since A-B̊-X constitutes a system in which there is a strain toward balance, all interrelations of A, B, and X can be specified. This A-B-X model was assumed to apply to individual-group relations in public school classroom groups of sixth grade children. Derived from this adaptation, hypothesis I was proposed: For children who like their classroom group there will be a positive relationship between perceived group attitude and own attitude toward academic achievement; for children who do not like their classroom group, the relationship between the two attitude variables will be equal to or less than zero.

This hypothesis was tested by dichotomizing the children in each of 14 sixth grade classes (N = 389) into a "liking" and a "not liking" category on the basis of a "liking for the group" scale. The individuals' attitudes toward academic achievement and their perceptions of their groups' attitudes toward academic achievement were measured by devices designed for this study. Rank order correlations were calculated between the scores obtained from these devices for both the "liking" and the "not liking" categories of children in each class.

For the "liking" category all correlations were positive, ten of the 14 correlations being significant. In the "not liking" category, none of the correlations was significant in the positive direction; two correlations were significant in the negative direction. A sign test between the correlation coefficients of the "liking" and those of the "not liking" categories over all classes was significant ($p = .05$ or better), indicating that correlations in the "liking" categories were higher in a positive direction than the correlations in the "not liking" categories of all classes. Hypothesis I was accepted.

The relationships between the two attitude variables for the intellectually superior and inferior (deviates) did not appear to be different from that of the entire group.

Hypothesis II postulated no consistent direction in the difference between the attitude attributed to the group and the one's own attitude for either the children who liked the group or for those who did not like the group. Sign tests were calculated between perceived group attitude scores and own attitude scores for the "liking" and the "not liking" categories in each class. The null hypothesis was accepted in the case of children who liked their

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

group (they perceived the group attitude to be more unfavorable than their own attitude) and rejected in the case of children who did not like their classmates.

For hypothesis III, that proportionately fewer subjects who are intellectual deviates than subjects who are not intellectual deviates will like their classroom groups, chi squares were calculated in order to ascertain whether there were differences among the three intellectual levels.

Whereas no statistically significant difference was obtained between the superior and the remaining majority, a proportionately greater number of the intellectual inferior tended not to like the group.

Microfilm $2.00; Xerox $5.60. 115 pages.

SOCIOLOGY

SOCIOLOGY, GENERAL

ROLE ACCOMMODATION: A STUDY OF NURSES AND ATTENDANTS IN A MENTAL HOSPITAL

(L. C. Card No. Mic 59-1079)

Fred Thomas Adams, Ph.D.
Tulane University, 1958

Chairman: Thomas Ktasenes

Organizational studies show that formal roles are often modified by employees in accordance with beliefs and attitudes they have about themselves, formal demands, and other employees. In other words, employees accommodate to the work situation by making organizational expectations more compatible with conceptions they bring to the work situation.

The central problem of this research was to determine what accommodations nurses and attendants in a modern Southern mental hospital make and to see how such accommodations fitted in with formal demands and expectancies of the reciprocal occupational group. Because these personnel, particularly nurses, have role difficulties in other hospitals, it was expected that they would have conceptions of themselves that are not completely reflected or realized in the work situation.

The problem was approached from the viewpoint of the reciprocal actors (11 nurses, 104 ward attendants) and from the observable demands of the organizational structure. Conceptions of each role, obtained through interviews and questionnaires, and observations made during an eighteen-month period were compared. Discrepancies between group responses and between actual and conceptualized performances were interpreted as evidence that there were problems requiring accommodation.

It was found that, formally, statuses and roles are rather clearly defined. The nurses' status-role is defined in terms of administrative functions, which are recognized and accepted by both nurses and attendants. The attendant's status-role is defined in terms of the action which is initiated toward him; his principal function is taking care of the patient as directed by professional personnel and administrative fiat.

Despite clarity of formal definitions, the nurse does not fully accept her role; nor does the attendant always accommodate his subordinate, low-prestige status. Mechanisms of accommodation employed by the nurse are in line with her conceptions of herself as a traditional nurse. She claims to perform nursing procedures and to have more direct contact with the patient than she actually does. She prefers to work with the patient to accepts or manifests his sickness and tends to avoid the patient who does not. She rejects or devalues nursing activities which are not conventional, such as engaging in recreational activities or freely interacting with patients. She tends to resent the fact that attendants carry out duties for which she was trained, finding fault with such performances or with the attendant's qualifications.

The attendant employs mechanisms which allow him to think of himself as a person of worth. He may apply informal sanctions against the nurse who makes him acutely aware of his inferior status, strive to keep fellow workers from distinguishing themselves from the group, or insist upon co-operation from all ward statuses. When possible, he tends to assume a nurse-like status which allows him to ignore his inadequacies; as a quasi-nurse he derives satisfactions similar to those of the nurse.

The patient who does not accept his sickness or fails to manifest sick behavior makes it difficult for the nurse or the attendant to establish complementary relationships with him that are favorable to their own self-conceptions. When other mechanisms, such as avoidance or co-operation, are not adequate to preserve self-images, the patient may be assigned a situational status which is meaningful to the employee. He may, for example, be conceived of as child-like, and the employee plays the role of parent.

The findings clearly indicate that a role is not determined solely by process. Rather, it is structured within a cultural framework of values, beliefs, and attitudes which are incorporated by the actors during socialization in various cultural groups and agencies. Actual situational demands appear to be partially ignored or perverted when they are contrary to such cultural conditioning.

Microfilm $6.05; Xerox $21.00. 474 pages.

EXPLANATORY CONCEPTS IN SOCIOLOGY

(L. C. Card No. Mic 59-478)

Melvin Theodore Bobick, Ph.D.
University of Illinois, 1958

A striking fact about present day sociology is the deep confusion concerning questions of the explanation of social phenomena. It even is uncertain if its function is explanatory: instead of explaining, its idea at times is that its science capacity is exhausted in mere description, measurement, prediction, the development of practical constructs. On the other hand, sociology espouses explanation; but then as regards what is to be explained and how things are to be explained it is woefully at odds with itself.

This thesis first reviews and criticizes the main positions rejecting explanation, and contends that interpretation and explanation of social phenomena is of the substance of social science. It then proceeds to an analysis and critique of the basic explanatory positions of present day sociology, the psychological, sociological Marxistic, mechanistic, biologistic, functionalistic. It argues that none of these prevailing modes of explanation is valid.

The reason sociology today operates with such a welter of unrelated and contradictory principles, it is developed, lies in the fact that sociology is without clarity concerning the object of its investigation. Having no clarity concerning its object, it is in no position logically to derive and develop the principles native to its object. Having none of its own, sociology reaches out into other sciences, natural and human, for elements of principle, with the consequences that it has become completely chaotic in its modes of interpretation and explanation.

This thesis maintains that the only way to a significant sociology, is by way of a fundamental redefinition of the aim and object of the discipline.

Microfilm $2.00; Xerox $6.00. 125 pages.

A STUDY OF THE SOCIAL ORGANIZATION OF A PLANTATION COMMUNITY IN THE COFFEE PRODUCING REGION OF SOUTHWESTERN VENEZUELA

(L. C. Card No. Mic 59-1167)

Bertram Leighton Ellenbogen, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Eugene A. Wilkening

The primary purpose of this study has been to describe and analyze the socio-cultural changes which have taken place in the community of Bramon as a result of shifts in its dominant agricultural organization from a family-type hacienda to a government-operated plantation. A second objective has been to compare the major aspects of the changing social organization of Bramon with the peasant typology formulated by Robert Redfield on the basis of his research in Tepoztlan and Chan Kom in Mexico.

This study was made in the Venezuela Andes during 1952-1953. Approximately four months were spent by the author in Bramon and ten weeks in the highland community of Chachopo. The data were obtained through family schedules, non-participant observation, informal interviews, and the use of archives.

The socio-cultural changes taking place in Bramon include the following:

1. The structure of the Plantation, at least in part, has contributed to the out-migration of males fifteen years and over.
2. Agricultural practices concerning seed selection, use of chemicals and coffee bean processing have become increasingly scientific. Work relationships have remained relatively unchanged. Attitudes of farm tenants toward land and labor have not become secularized.
3. The Plantation's emphasis on a single cash crop, coffee, has resulted in much of the material goods consumed by local inhabitants to be imported from outside the community.
4. The installation of modern machinery and the establishment of a modern office management system on the Plantation has required the recruitment of specialists from the outside. These specialists provide additional outside contact with urban attitudes by some segments of Bramon.
5. Large-scale coffee production on the Plantation requires a sizeable migrant labor force. A majority of this force comes from Columbia, contributing to the heterogeneity of the local population for at least part of the year.
6. The Plantation is dependent for its operations on permanent labor provided by parceleros and pisatarios. Income of the former tenure group is derived from the production of their parcels. The pisatarios work for daily wages. Differences in working arrangements contribute to differentials in levels of living.
7. The impersonal relationship maintained between the Administration and the farm tenants results in limited identification with the Plantation.
8. Frequent changes in the directorship of the Plantation has led to a series of changing and sometimes contradictory policies, causing anxiety and insecurity among the farm tenants.

The second objective of this research has been to compare the principal characteristics of Redfield's "peasant type" with those of Bramon. The latter approximates the "ideal" type in nine of twelve traits. The greatest deviation from this type occurs in family relationships, identification with the societal group, and in person relationships

It is evident from the description of the national setting of this study that socio-cultural changes have been occurring in Venezuela. When selected aspects of the social organization of Bramon are compared with a second community, Chachopo, the former are seen as more secularized.

It seems probable, then, that the position of Bramon on the folk-peasant-urban continuum results from its interaction with the outside world. In Bramon, an added causal explanation is the existence of the Plantation which reinforces the influence of the city. The Plantation which

changes the nature of property rights and the overall control of the local economy affects the extent of kinship relationships, identification with the community and to a lesser extent, the personal relationships within the locality.

These deviations from Redfield's peasant type indicate a need for creating additional types. Only in this manner may the classification of societies be refined and extended.

Microfilm $3.80; Xerox $12.80. 295 pages.

THE SOCIOLOGICAL THEORY OF FLORIAN ZNANIECKI

(L. C. Card No. Mic 59-511)

Hyman Henry Frankel, Ph.D.
University of Illinois, 1958

A critical analysis of Florian Znaniecki's prolific array of published writings in sociology reveals one of the few contemporary efforts in this discipline to forge a comprehensive, systematic theory of "social reality" in strict accordance with the logic and canons of scientific method. In opposition to the prevailing emphasis on empiricism and preoccupation with the refinement of research technology in modern sociology, Znaniecki has been a most vigorous advocate of the primary need to formulate an explicit theoretic framework as the logical prerequisite for the development of a scientifically significant body of sociological knowledge. Furthermore, paralleling his thoroughgoing criticism of sociology for its aimless amassing of isolated and theoretically irrelevant research information, Znaniecki finds in the current tendency of sociologists to import psychological principles in their efforts to describe and explain the social life of man the "winds of false doctrine".

To establish a solid foundation for the development of sociology as a science, Znaniecki formulates, in detail, two indispensable, methodological postulates. In one is demonstrated the need for an approach to the "cultural sciences" quite distinct from the approach to the natural sciences. This defines the world of nature and the world of culture as two logically distinct domains of reality. The world of culture cannot be comprehended by natural science categories; and any attempt to do so leads inevitably to a false reductionism. Simply, the cultural sciences must develop their own categories appropriate to the distinctive character of cultural phenomena. In contrast to the "things" and "processes" which appear as data to the natural scientist as if they exist independent of human thought and action, the data of culture are precisely the products of human thought and action. That is, the data of cultural reality are specifically the values and activities of human agents, and the scientist must experience them only as they are defined and experienced by the agents being investigated.

The second methodological principle demonstrates the need for identifying sociology as a special cultural science with a clearly delimited field of research. Rejecting all tendencies to define sociology as a general science of culture, or of society as a totality, he restricts the object matter of sociology to a specific realm of cultural reality: the social. According to this conception, all the data of sociology must fall into one of four, main logical categories for purposes of theoretic analysis: (1) theory of social relations; (2) theory of social roles; (3) theory of social groups; and (4) theory of "societies".

Based on the above presuppositions, and following their logical implications with systematic rigor, Znaniecki makes some fundamental and distinctive, substantive contributions to a sociological theory of social evolution and the sociology of knowledge, as well as formulating an entirely original system of hypotheses concerning a sociological theory of nationalism. All of which bear eloquent testimony to the existence of one of the most fertile systems of thought in modern sociology, albeit one of the most sorely neglected.

Microfilm $7.25; Xerox $25.00. 571 pages.

THE CONSISTENCY OF SOCIOLOGICAL VARIABLES IN PREDICTING THE ADOPTION OF FARM PRACTICES

(L. C. Card No. Mic 59-1516)

Alvin Sutton Lackey, Ph.D.
Cornell University, 1958

The problem dealt with in this thesis has three parts: (1) how consistently do sociological variables predict the adoption of farm practices over time and for different farm enterprises, (2) what changes have taken place in the adoption of selected farm practices between 1947 and 1957, and (3) how do farmers who have maintained their enterprises over the ten year period differ from the total population of which they are a part.

The study was performed in Schuyler County, New York using data which were collected on identical farm practices in 1947 and 1957. In addition, an expanded set of practices were studied in 1957 which were not included in the 1947 survey.

Adoption scores were computed for farmers who had a dairy enterprise, a poultry enterprise, and/or a sheep enterprise and classified into high, medium, and low categories of adoption. A battery of 18 variables was used in predicting adoption for each set of practices and for each time period. The technique employed in making these predictions was the coefficient of relative predictability.

Changes in the level of adoption of all practices were shown by reporting the percentage of farmers adopting each practice for each time period. The characteristics of farmers who have maintained their enterprises over the ten year interval were shown by contrasting them with the total population on each of the independent variables used in the prediction of adoption.

The findings of this study show that non-religious participation is the best and most consistent variable in the adoption of the practices studied. On the whole it has a predictive accuracy of 55 per cent which is over 20 per cent more accurate than chance.

The consistency in the predictive efficiency for each variable was demonstrated through rank correlation coefficients ranging from .59 to .79.

The analysis of changes in the adoption of farm practices showed that there has been a general increase over the decade in the percentage of farmers adopting the practices studied. The median amount of change in adoption was +14.8 per cent.

The analysis of farmers who have maintained their

enterprises over the ten year period showed that in relation to the total population in 1947 they tended to be younger, to have more education, to have a higher level-of-living, to have more acres in crops, to have larger herds or flocks, to have more enterprises, to have farming as a major enterprise, to have higher scores for total participation, family participation, and non-religious participation, to be lower in religious participation, to have a greater knowledge of the extension service, to be members of the extension service, and to have a higher degree of participation in extension activities, to be less well satisfied with the extension service, to have higher scores on exposure to information sources, and to have higher adoption scores if they were dairy or sheep farmers. In 1957 these farmers were still different than the total population on most of these variables but approached the population distribution more closely for others.

The conclusions of this study were: (1) non-religious participation is the best and most consistent predictor of practice adoption, (2) the practices studied have an affect upon which variable will be the best predictor of adoption, (3) the varying rate of change in the adoption of practices is partly determined by the practice itself, and (4) the farmers who are giving up their enterprises are being replaced by farmers with characteristics more nearly like those who retain their enterprises.

Microfilm $2.30; Xerox $8.00. 175 pages.

AN INDEX OF SOCIO-ECONOMIC VARIABLES AFFECTING SPATIAL DISTRIBUTION IN AMERICAN CITIES, AN EVALUATIVE STUDY

(L. C. Card No. Mic 59-553)

John Campbell Osoinach, Ph.D.
University of Illinois, 1958

This study had as its basic aim the testing of an index of urban socio-economic class structure. From U. S. Census material, this index, called the Farber index, utilizes figures for census tracts which are manipulated to produce four basic scores. There is a score for: (a) occupation, (b) education, (c) income, and (d) race. The total of these four gives the socio-economic rank score for the census tract. Depending upon the order and size of the four basic scores, a census tract is said to fall into the general pattern of the Farber index or to deviate from it. A profile of the city results from the number and rank of general patterned census tracts and of those tracts deviating from this general pattern.

The validity of the Farber index was established first by comparing it to the Shevky-Bell index of urban socio-economic class structure, which is widely accepted and frequently used in sociological research. These authors applied their index in an analysis of the San Francisco Bay area. This comparison of indexes entailed the formulation of the first two of three hypotheses tested. The first hypothesis predicted that there would be a positive association between the socio-economic rank scores of the Farber index and the social rank scores of the Shevky-Bell index. The second hypothesis predicted that those census tracts which deviate from the general pattern on the Farber index would generally have higher scores on the Shevky-Bell urbanization index than would those census tracts falling into the general pattern. Contingency table comparisons and chi square tests of statistical significance served to substantiate these two hypotheses. The results indicated that the two indexes were, in general, similar instruments - each providing profiles of the socio-economic class structure of American cities.

Further application of the Farber index entailed the formulation of the third hypothesis. Nineteen American cities ranging in population from 71,000 to 468,000 were classified as to specialization of economic activities as predominantly manufacturing or predominantly trade. Northern and southern cities were treated separately. The third hypothesis predicted that manufacturing cities, compared to trade cities, would have a higher proportion of their census tracts falling into the general pattern. Ideally, the general pattern seems to represent a rectangular, continuous class structure. The deviant patterns, being more susceptible to chance variations in the four index characteristics, especially in the middle range of socio-economic ranks, would more likely reflect a bi-polar crystallization of class structure. Comparison of proportions substantiated this third hypothesis. Hence manufacturing cities, on the basis of their performance on the Farber index, were shown to tend more toward a continuous socio-economic class structure than trade cities.

There are three principal implications of this study. First, the Farber index distinguishes between the ecological patterning of manufacturing and trade cities, showing that differences in occupational structure influence the residential distribution and class structure of American cities. Second, because of its wide applicability with a minimum of computation, for some purposes, the Farber index may be preferable to the Shevky-Bell index. Third, a question is raised as to the unidimensionality of the Shevky-Bell use of urbanization.

Microfilm $2.50; Xerox $8.80. 192 pages.

PERSONALITY CHARACTERISTICS, ATTITUDES, AND PEER GROUP RELATIONSHIPS OF ACCIDENT-FREE YOUTHS AND ACCIDENT-REPEATING YOUTHS

(L. C. Card No. Mic 59-769)

Robert Charles Sherwood Rommel, Ph.D.
The Pennsylvania State University, 1958

Statement of the Problem

The problem of this thesis was to determine if accident-free and accident-repeating youthful drivers differed with regard to personality characteristics and attitudes. Furthermore, if such differentiating characteristics could be discerned, the question presented was whether these characteristics could be shown to be a resultant of group formation. In other words, do there exist any similarities between an individual and his peers with regard to characteristics which differentiate between accident-free and accident-repeating youthful drivers?

Research Populations and Design

Two groupings of youths from various high schools in Pennsylvania were obtained. Each grouping consisted of

twenty-five individuals categorized with respect to being accident-free or accident-repeaters. Accident-repeaters were defined as individuals having had two or more traffic accidents while serving in the capacity of driver. The accident-free population was considered a control group.

In addition, each individual in the two groupings selected two peers making a total of four groupings, accident-free, accident-repeaters, accident-free peers, and accident-repeater' peers.

Method and Procedure

Each individual was administered a driver attitude inventory which had previously been pre-tested and was capable of discriminating between the accident-free and accident-repeater individuals. Five sub-scales of the Minnesota Multiphasic Personality Inventory, namely the Hypomania, Psychasthenia, Paranoia, Psychopathic Deviate and Schizophrenia, were administered also. On the basis of the scores obtained on the above scales, the four groupings were analyzed.

Conclusions

It was found that accident-free and accident-repeating youths tend to differ in attitudes as measured by the attitude inventory. The inventory was not scalable according to the Guttman technique and it was assumed that it measured many dimensions.

It was also found that accident-free and accident-repeating youths tend to differ with respect to the Hypomania and Psychopathic Deviate scales. These scales indicate an individual's disregard of social mores and defiance of authority, and an individual's tendency toward excessive activity and enthusiasm. The tendency of accident-repeating youth to score higher on these measures has led the investigator to believe that a series of personality characteristics may be considered directly associated with the accident-phenomenon.

From within the five sub-scales of the MMPI, eight items discriminated between the two groupings. These items are associated with factors in the immediate experience of the individual such as parental difficulty, trouble with the law, tendency to be impatient with others and the like.

There was no statistically significant relationship discovered among the individuals and their peers with regard to any of the above measures of personality and attitudes. This does not mean, however, that such relationships may not exist, but that they are not measurable by the above techniques.

The research was conducted in order to discover if personality characteristics and attitudes differed between the dichotomous categories. It is believed that such differences exist as shown by the above measuring techniques and that also further differences await discovery by newer and more refined techniques.

Microfilm $2.00; Xerox $5.80. 120 pages.

VALUE-ORIENTATIONS, SOCIAL STRUCTURE AND OCCUPATIONAL CHOICE

(L. C. Card No. Mic 59-1198)

Harry Karl Schwarzweller, Ph.D.
Cornell University, 1958

The main purpose of this research was to study a choice-making situation concerning high school young people in New York rural communities and decisions they must make about future education and work. The problem was to discover what factors influence these choices. The research traced causal connections between value-orientations, social structure and occupational/educational choices.

An operational theory was constructed which is a synthesis of an extensive review of the literature germane to the empirical problem. Occupational and educational choice is regarded as a narrowing down process; the aspirations and plans of these young people are considered as steps in the causal sequence leading to the actual choice.

Twelve values were included in the battery: achievement-success, material comfort, security, hard work, mental work, creative work, work with people, service to society, individualism, familism, external conformity, friendship. It was hypothesized that each of these values is functional in the work/education context. The measuring instruments are "forced choice" situations and the measurement is the quantification of consistent directionality in selections from alternatives. A modified method of latent structure analysis was employed in the construction of the scales. Standardization of the scales on the entire sample showed high statistical reliability using internal criteria.

Two hundred and forty juniors and seniors in four typical rural central schools constituted the sample. These communities are in areas that must encourage some of their people to find jobs elsewhere than in the rural sphere of activity.

The data supported the hypothesis that there is a causal relationship between an individual's value-orientations and the choice that individual makes from among the alternatives available in the process of educational and occupational selection. Not all the values included in the battery were shown to be functional to any one situation. A list of specific generalizations is postulated as an empirical guide for future study.

A number of status variables were tested for association with these choices. The data strongly supported the hypothesis that there is a causal relationship between the status position held by an individual in the social structure of society, family and school and the choice that individual makes in the process of educational and occupational selection.

It was also demonstrated that:

Influence from a differential rural-urban background is negligible as a determinant of educational/occupational choice.

The more education the mother has, the higher aspirations the child will tend to develop in his educational and occupational choices.

The higher the individual's I.Q., the higher his aspirational level and plan.

The status position of a young person's family of origin influences his value-orientations.

The sex of a young person is a strong influence in determining his value-orientations.

The status position achieved by a young person in the school system influences his value-orientations.

The I.Q. of a young person is significantly related to his value-orientations.

The degree of rural background to which a young person is exposed does not show any demonstratable difference in his value-orientations within the scope of the educational/occupational context.

It was concluded that values are important in the specific situational context, but the position an individual occupies within the social structure plays a major role in determining his education/occupational future.

Microfilm $2.65; Xerox $9.20. 202 pages.

PERSONAL, SITUATIONAL, AND COMMUNICATIONAL FACTORS ASSOCIATED WITH THE FARM PRACTICE ADOPTION PROCESS

(L. C. Card No. Mic 59-772)

Maurice Lucien Sill, Ph.D.
The Pennsylvania State University, 1958

New products, practices and ideas are constantly being introduced into society. Availability, however, is no guarantee of use. Instead individuals are found to be differentially disposed to the acceptance of new ideas. The purpose of this study was to analyze the factors associated with the variability among people in the acceptance of three farm practices, insect control in legumes, use of grass silage, and installation of hay finishers.

Selected personal, situational and communicational factors were related to the stages of farm practice adoption. Case histories were secured from 175 dairymen in a Pennsylvania County regarding the stages they passed through in adopting the three practices.

Respondents were classified by the stage of adoption attained: awareness, interest, acceptance, trial, and adoption. An attempt was made to analyze adoption as a process by examining individuals at various stages. The result was a series of views at specific stages which could provide useful insights into the adoption process.

The practice adoption process was positively associated with such personal characteristics of the individual as education, production aspirations, attitude of professionalism, and negatively associated with age.

Positive association also existed with such situational factors as income, size of farm, level of farm mechanization and the extent to which other new practices were used.

In addition, practice adoption was related to the farmers' orientation to society as measured by: degree of exposure to interaction with farm agencies and organizations; evaluation of the information from mass media, agencies, and commercial sources; and the type of media used as sources of information at various stages of adoption.

By conceiving of adoption as a process or sequence of orientations to new technology a differential effect of various personal, situational and communicational factors is observed, stage by stage in the adoption process. Mass media were most effective in the early stages of adoption. Thereafter, reference groups as measured by degree of interaction with and evaluation of agencies and organizations become important. Slightly later the influence of peers is positively associated with progress through the stages. In the final stages, the situational factors such as income, size of farm and farm mechanization become crucial in the transition to the next higher stage of adoption. Individuals who have the crucial factors at the optimum point of time are most likely to become adoptors.

Microfilm $2.00; Xerox $5.80. 120 pages.

SOCIOCULTURAL CHANGE AMONG THE CHINESE OF SEMARANG, INDONESIA

(L. C. Card No. Mic 59-1199)

Donald Earl Willmott, Ph.D.
Cornell University, 1958

This dissertation is a community study of a minority group in a rapidly changing, non-Western, urban setting. It is also an attempt to develop and apply an empirically relevant theory of sociocultural change. Survey methods as well as standard anthropological techniques have been used to gather information on the social and economic life, ethnic group relations, religions, and family patterns in this community.

A middle-range theory of sociocultural change has been developed and partially elaborated, as a basis for analyzing the changes taking place in the society and culture of this community. The theory begins with five major hypotheses which specify, at a high level of generalization, the conditions under which innovations will be accepted in a group. These hypotheses deal with five types of change which have been labeled, respectively, purposive, emergent, necessitated, imposed, and emulative change. It is suggested that determinate, derivative hypotheses can be progressively elaborated. A number of such hypotheses have been proposed in the theoretical discussion of changes in this community. An effort is made to give determinate definitions for the concepts and variables involved. For instance, the kind of "prestige" which is considered to be the salient variable in emulative change is defined, and observable indices are outline, on the basis of psychological theories of identification and the sociological theory of reference groups.

Chapter I outlines and evaluates the writer's sociocultural change theory, and relates it to other theories, such as functionalism. Each succeeding chapter ends with a section in which the data is discussed in terms of the theory presented. These sections are intended both to illuminate the specific processes of change observed in the community, and to suggest derivative hypotheses for the theory.

Chapters II and III provide the demographic and historic background for an understanding of the changes taking place among the Chinese of Semarang today. The Chinese constitute about one-sixth of the 360,000 people of this central Javanese city. Their society and culture have been greatly influenced by the new environment, by their dominant position in the Indonesian economy, by Javanese culture (especially as presented by the native wives of the early immigrants), by communication with a changing China,

and by the government regulation, the schools, the publications, and the living example provided by the Dutch colonials.

In the remaining chapters, influences from these various sources are emphasized in the description of the following aspects of community life: occupations, economic organization, and business orientations; relations between ethnic groups; linguistic, educational, and socio-economic sub-grouping; voluntary associations; community leadership; education and the school system; religious and magical beliefs, practices, and organizations; family organization, marriage arrangement, and the roles and statuses of women and youth.

In summary, it may be said that the Chinese of Semarang constitute a somewhat heterogeneous community which nevertheless remains distinct from Indonesian society. Their culture is a unique and changing combination of elements from traditional China, modern China, Indonesia, and the West. Microfilm $6.55; Xerox $22.80. 516 pages.

SOCIOLOGY, FAMILY

PREDICTING THE 1953 SOCIAL ADJUSTMENT OF 63 MALES AND FEMALES KNOWN TO THE JUVENILE COURT AS INCORRIGIBLE IN 1941-1942: A PROBLEM IN PREDICTION

(L. C. Card No. Mic 59-1269)

Dorothy Delilah Hayes, Ph.D.
University of Minnesota, 1958

The following major hypothesis was explored: trained and experienced social workers can predict more accurately than chance the 1953 favorable and unfavorable social adjustment of boys and girls known eleven years previously to the juvenile court[1] for the delinquent offense classified as incorrigibility. Sixty-five incorrigibles were selected from a total of 76 who during an eighteen month period (January 1, 1941 to July 1, 1942) appeared before the juvenile court. In each instance one or both parents signed the petition of delinquency and made the complaint of incorrigibility. Eleven of the 76 petitions were signed by persons other than a parent and were not included in the single non-random sample. One male and one female were lost to the terminal sample of 63 as their whereabouts in 1953 was undisclosed.

A case history for each of the 65 juveniles was compiled. Social, psychological, court, health, and in some cases, psychiatric data pertaining to the incorrigible and to members of his family up to and including the years 1941 through 1943 were included. In 1953, twelve social workers read the case histories and predicted the 1953 social adjustment of thirty-eight males and twenty-seven females. The actual 1953 social adjustment was based upon data collected from health and welfare records (334) and by follow-up interviews (89) in 1952-1953. Whether the association existing between the predicted and actual 1953 outcomes was due to chance or to the accuracy of the judges in predicting was the basic question.

The actual 1953 outcomes were based on seven elements comprising a definition of favorable and unfavorable social adjustment which were applied to the sixty-three case situations during any portion of a five year period 1949-1953. An individual was adjusting favorably in 1953, if during the five years he or she was not known to public authorities or to persons interviewed (1) to have been hospitalized for mental illness, (2) to state penal authorities, (3) to have been paroled from a correctional institution, (4) to have been physically incapacitated with a serious disability, (5) to local private or public social agencies for economic assistance for more than six months (ADC was an exception), (6) to have been remarried and divorced during the five year deciding period, (7) to local police, municipal, county or district courts, or to a private or public social agency for child neglect, desertion, drunkenness, immorality, or prostitution, and (8) if male, he was known to have been regularly employed during the years 1949-1953. An individual was adjusting unfavorably in 1953, if during any portion of the five year period he was known to public authorities or to persons interviewed to fit any one of the seven categories, and if male, he was known to have been irregularly employed during the years 1949-1953.

Differences between the predicted and actual outcomes were tested by χ^2 (corrected for continuity) and probability values were considered significant at the .01 level. Analysis of the data showed that the judges were: (1) significantly accurate in predicting the unfavorable outcomes for the study sample and for the female sub-sample ($\chi^2 \geq 17.76$, $P < .001$, and $\chi^2 \geq 14.49$, $P < .001$); (2) moderately accurate in predicting the male unfavorable outcomes ($\chi^2 \geq 6.47$, $.02 > P > .01$); (3) more accurate in predicting the female than male unfavorable outcomes ($\chi^2 \geq 4.55$, $.05 > P > .02$); (4) not as accurate as chance in differentiating the favorable male and female outcomes ($\chi^2 \geq .40$, $.70 > P > .50$). Microfilm $3.25; Xerox $11.20. 252 pages.

1. Hennepin County, Minneapolis, Minnesota.

PREMARITAL ORIENTATION AND EXPECTATIONS OF COLLEGE YOUTH

(Publication No. 21,508)

Rulon Squires McCarrey, Ph.D.
University of Utah, 1959

Chairman: Rex A. Skidmore

This study has been made for the purpose of determining premarital orientation and expectations of a group of college youth whose ages closely approximate the median age of first marriages in mid-twentieth century United States. The modal respondent in this study of college freshmen, sophomores, juniors, and seniors is nineteen years of age.

A questionnaire was devised as a means of obtaining attitudinal responses of college students regarding various facets of their premarital orientation and expectations. The questionnaire was administered to 443 students of Ricks College, Rexburg, Idaho. Ricks College is owned and operated by the Church of Jesus Christ of Latter-day Saints, and while students from various parts of the world, representing several different religious denominations, attend Ricks College, 95.5 per cent of the respondents of this study are members of the Church of Jesus Christ of Latter-day Saints.

After the questionnaire was administered to the sample, the response data were coded and punched on I.B.M. cards. The data were then sorted and tabulated; and response percentages were computed for various respondent groupings. The proportion of male and female respondents in this study is almost equally divided, with the male respondents constituting 51.5 per cent of the total sample. A Chi-square test of significance was made of the comparisons used in the study.

The respondents of the present study have been influenced and conditioned through the medium of various channels of orientation other than the family of orientation. The family of orientation, however, may be considered a prime orientor because of its early and continuing influence on the persons involved. All of these respondents have experienced at least twelve years of formal academic training in addition to various other individual experiences.

Various premarital attitudes have been expressed by the respondents of this study concerning practices and expectations related to dating, courtship, engagement, marriage, and children in the home. Even though some of the dating, courtship, and engagement practices might not be conducive to marital preparation and adjustment; nevertheless, they become part of one's premarital orientation and help determine one's marital expectations.

Basic conclusions.--The following basic conclusions have resulted from this study of premarital orientation and expectations of college youth:

1. The attitudes of youth regarding family life are similar to the attitudes of their parents--indicating the prime position of the family of orientation as an agent of premarital orientation.
2. Youth are encouraged by their parents to make their own decisions, yet comparatively little opportunity is provided in the parental home for youth to participate in family council which permits all family members to express their feelings and views.
3. In a homogeneous group, religion is very important in conditioning attitudes, as is evidenced by moral standards, and in-group dating.
4. Considerable differences are apparent in the premarital expectations of the respondents of this study with regard to self, prospective mate, and prospective children.
5. Youth are moving from a patriarchal family organization toward increasing family democracy. The contemplated propriety of husband sharing household tasks, and wife working outside the home are examples of this tendency.
6. According to the respondents of this study, married children should contribute financially for the care of their aging parents.
7. Discipline is not expected to be any more strict in the family of procreation than the discipline which has been experienced in the family of orientation.
8. Premarital expectations are apparently somewhat romantically unrealistic.
9. Youth have mixed feelings regarding marriage counseling. While relatively few have considered consulting a professional marriage counselor, the majority sense a need for premarital or marriage counseling.
10. The need of an increased amount of family life education and marriage counseling is indicated by the findings of this study.

Various data presented in this study suggest further research studies which may help fill in some of the significant gaps of contemporary knowledge concerning the basic institution of society. It is hoped that this pilot study might be employed, at least in part and in comparable manner, in the study of other sample populations.

Microfilm $2.10; Xerox $7.40. 160 pages. Mic 59-1931.

SOCIOLOGY, RACE QUESTION

A COMPARATIVE STUDY OF THE PERSONALITY STRUCTURES AND PROBLEMS OF NORTHERN AND SOUTHERN NEGROES IN TERMS OF THE EFFECTS OF DIFFERENTIAL CASTE SANCTIONS

(L. C. Card No. Mic 58-7852)

Bertram P. Karon, Ph.D.
Princeton University, 1957

The object of this investigation has been to discover the relationship between a set of social institutions in a complex western society and the personality structures of the people in that society. The particular set of institutions which were studied were the caste sanctions -- those institutions which perpetuate the Negro as an hereditary, endogamous, and especially as an inferior group. Only their effects upon Negroes, i.e., those who are assigned the inferior status, were examined.

A sample of subjects whose lives were essentially untouched by the caste sanctions (northern whites) were compared on a large number of variables with a sample living under relatively severe caste sanctions (southern Negroes). Eleven variables were found which seemed to differentiate the two samples, and these were combined to form a crude discriminant score. The effects of various background variables other than the caste sanctions were examined and found not to account for the differences between the samples.

Two completely independent experiments were carried out in which a sample living under less severe caste sanctions (northern Negroes) were compared with a sample living under more severe caste sanctions (southern Negroes). In each case, the difference between the two samples on the discriminant score was in the predicted direction and was greater than could reasonably be attributed to chance, even after the effects of extraneous background variables had been taken into account.

It is clear, therefore, that the caste sanctions have an effect upon the personality structures of the people who feel them, and that this effect is reflected in these eleven variables. The fact that northern Negroes differ from southern Negroes on precisely the same variables and in the same direction as do northern whites served to eliminate the possibility that these variables represented hereditary differences between Negroes and whites.

An additional pair of samples, matched on age, sex, education, and vocabulary, were used to elucidate the findings. The relationship to the caste sanctions of the individual hypotheses (i.e., the eleven differentiating variables considered one at a time) was investigated in some detail.

One striking finding is that, of the eleven differentiating variables, ten are indicators of pathology. What this implies is that the impact of the caste sanctions on human beings is destructive, and the destructiveness varies with the severity of the sanctions.

On this basis, we may reject the previously plausible arguments that (1) the southern Negro, who lives in a self-consistent culture, is not disturbed by the caste sanctions which become a problem only for the northern Negro, who lives in an inconsistent culture; or (2) the conditions under which Negroes live in the United States are at best so unpromising that the differences between North and South are not appreciable. From our study, it is clear that the difference between North and South is considerable in terms of the human cost. Indeed, even within the South, the difference between an area of severe sanctions and an area where they were less stringent is paralleled by an appreciable decrease in the human cost.

Microfilm $2.75; Xerox $9.40. 210 pages.

CONSEQUENCES ENCOUNTERED BY NEGRO TEACHERS IN THE PROCESS OF DESEGREGATION OF SCHOOLS IN FOUR SOUTHERN STATES

(L. C. Card No. Mic 59-1518)

Albert Westley Spruill, Ed.D.
Cornell University, 1958

The Supreme Court of the United States in the historic ruling of May 17, 1954, set in motion one of the most significant social conflicts in this century. It emphatically stated that segregation in education is no longer legal.

Since the Court's decision, a considerable amount of material has been written regarding its effects on students and education in general. But an examination of pertinent literature shows that little attention has been given to the Negro teacher in the process.

This study investigates the consequences encountered by Negro teachers in the process of desegregation and considers such pertinent questions as the following:

1. Where desegregation has taken place have Negro teachers been utilized?
2. On what basis have Negro teachers been employed?
3. How have they fared in instances where they have occupied positions in mixed schools?

The purpose of this study was: (1) to ascertain the consequences relating to employment encountered by Negro teachers in the desegregation process; (2) to discover other consequences encountered by Negro teachers resulting from or following the process of desegregation; and (3) to compare the consequences encountered by Negro teachers in sparse and densely settled areas.

Three significant methods were used in obtaining information for the study: (1) an analytical or historical study was made of official records to determine the consequences relating to employment encountered by Negro teachers in the desegregation process; (2) the survey technique was used wherein questionnaires were mailed to Negro teachers who were working in desegregated schools as a result of the Supreme Court decision of 1954 to ascertain the consequences they had encountered following the process of desegregation; and (3) an interview-observation was held with selected teachers in both sparse and densely settled areas of the states surveyed to obtain information for case studies which would not only reinforce the data gained by the questionnaires but also would indicate whether these consequences were of an individual nature or common to the group.

Findings obtained in a study of Negro teachers in Delaware, Kentucky, Maryland, and West Virginia show:

1. Negro teachers have experienced both losses and gains in terms of employment in the desegregation process. However, in most instances the gains have exceeded losses.
2. Negro teachers have suffered occasional losses in terms of jobs in Kentucky and West Virginia, but at the same time have shown significant gains in these states as well as Maryland and Delaware.
3. In only one school district among those studied, Baltimore, Maryland, have Negro teachers been hired in public schools since desegregation to any appreciable extent.
4. The consequences encountered by Negro teachers in the process of desegregation in regard to physical, professional, social, student-teacher relations, and parent-teacher relations have been better.
5. The future of the Negro teacher in terms of employ ment in desegregated schools remains uncertain and indefinite.
6. There is little difference in the consequences encountered by Negro teachers in the process of desegregation in a metropolitan community where the school population is majority-white and in smaller communities where the school population is majority-white.
7. In the metropolitan community where the school population is minority-white Negro teachers have experienced no more adverse consequences than those in smaller communities and in metropolitan communities with a school population which is majority-white.
8. It appears that in each community studied, where Negro teachers felt the consequences were better, there were good race relations prior to and following the Supreme Court decision, the educational leadership was firm, a considerable number of barriers in regard to social institutions had been lowered, and the Negro population was small as compared to the total population.

Microfilm $2.20; Xerox $7.80. 167 pages.

THE DRAMATURGY OF JEAN ANOUILH

(L. C. Card No. Mic 59-1251)

Philip Andrew Benson, Ph.D.
University of Minnesota, 1958

This study views Anouilh's drama as the product of a "man of the theatre" and through a structural analysis of his twenty-one major plays arrives at certain conclusions regarding the "conventions" of this theatre.

Part One provides an introduction to the playwright, his generation's theatre, and the evolution of his critical reputation with public and critics. Part Two examines the dramatist's use of seven basic dramatic devices, considering his utilization of each in the structure of three representative plays. The patterns and trends which emerge in the resulting "diagonal" analysis serve to define the dramaturgy of Anouilh's total work to date.

Structure: through the use of such devices as the play-within-a play, the deus ex machina ending, and other contributants to contrast, contrivance and the maintenance of make-believe, realism is eschewed without, however, any unsanctioned loss of emotional empathy on the part of the audience.

Situation: usually that of family or the traditional triangle, the typical situation is circumscribed, carefully contrived, and not particularly original.

Characterization: this element varies widely as to quantity and quality. Anouilh's penchant for families and types, his tendency to use the same characters from play to play, and the leading characters' pre-occupation with themselves as role-players in a past-determined destiny help to limit their freedom to the dimensions of stage reality.

Action: contributing to exposition of character, situation and theme, action is also employed for its own sake as a source of pure comic and histrionic pleasure.

Dialogue: the language is frequently highly poetic in its economy and its metaphoric and emotional content. Delineating character and contrasting effectively with the other devices of the plays, it is eminently suited to stage requirements.

Music and Dance: both assist in the mechanization of action, the contrast of devices within the play and the unification of the whole. By helping to divorce the play from reality they contribute further to the desired quality of make-believe.

Setting and Costume: these devices help to sustain two levels of reality and understanding on the part of both characters and audience. Their contributions to overall theatricality additionally assist in maintaining an effective quality of "play" throughout.

The contrast and concordance of these seven devices serve also to comment and explain, and to maintain the proper blend of verisimilitude and theatricality which the playwright wishes to effect. The observation that Anouilh is often most emotionally moving in his most theatrical plays tends to support the theory that belief in the reality of the stage events is not requisite to emotional involvment on the part of the audience.

Part Three considers, in turn, four dramatic practices or "conventions" which appear consistently throughout the the preceding analyses: manipulation, alienation, impurity, and parody. Manipulation describes, basically, the relationship between the playwright and the characters while alienation refers to the relationship between the characters and the audience. Impurity recalls the constant and purposeful mixture of genres within a single play. Parody, directed principally toward the theatre world, provides both amusement and criticism.

These four general dramaturgical practices are kindred in their rejection of strict stage illusion and in their return to the more theatrical conventions of the pre-realistic period. If Anouilh's theatre survives the interest which this generation has suscribed to it, the reasons will lie not so much in his simple rejection of the conventions of realism as in his clear acceptance and mastery of the basic and traditional conventions evidenced throughout dramatic history. The debate as to Anouilh's literary stature continues; his position as an unusually skillful and imaginative theatre craftsman appears secure.

Microfilm $4.10; Xerox $13.80. 319 pages.

THE EFFECTS OF PRESENT AUDIENCE REACTIONS ON REMOTE AUDIENCES IN POLITICAL PERSUASION

(L. C. Card No. Mic 59-1271)

Paul Ezra Herbold, Ph.D.
University of Minnesota, 1958

It was the purpose of this study to determine experimentally the relative effectiveness of oral, persuasive political discourse with respect to remote audiences by varying the stimulus synthetically to produce an apparently live-audience situation on the one hand and a studio-originated situation on the other, holding constant the content and delivery of a single speaker.

Relative effectiveness was determined by measuring opinions of 246 University of Washington Sociology students and 103 Western Washington College of Education. students toward the subject of foreign aid both before and after exposure to recorded speeches designed to influence opinions in the direction of favoring continuation by the U. S. of a strong foreign aid program. The students at each institution were divided into three groups of approximately equal size, those that heard only the rally-originated speech, those that heard only the studio-originated speech, and those that heard neither. The difference between results on the pretest and post test, corrected by whatever shifting occurred among Control subjects, was deemed to

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

constitute the shift-of-opinion induced by the three treatments.

The scales developed for use in the experiment were of original design, borrowing, however, features of both the Likert attitude scale and the shift-of-opinion ballot. A battery of five issue-statements relating to the subject of foreign aid was buried in the pretest among six additional batteries of five statements each dealing with other national political issues. Parallel issue-statements, along with speaker and speech ratings, comprised the post test. The key issue-statement was one which proposed a substantial reduction in foreign aid spending.

Three criteria adopted to determine relative effectiveness of rally versus studio speaking were: (1) gains in Likert scale means as between the pretest and post test on the foreign aid battery, (2) gains on the key question, and (3) shifts in the intended direction as determined by percentage distributions in the categories of pro, neutral, and con. An analysis of variance was also utilized.

The following were the major findings of the study:

1. Audience facilitation extends to remote audiences. Within the limitations of the experiment, the Rally speech was more effective than the Studio speech in shifting opinion toward foreign aid in the desired direction.

2. The opinions of students toward a specific, contemporary, and highly controversial public question can be measured, influenced, and remeasured accurately at the current stage of social research.

3. A twenty minute talk on a timely, crucial political issue can shift opinions significantly.

4. A unit of persuasive, oral discourse can be created and delivered so that it will produce credibility either when used as a studio-originated speech or when modified by "dubbing in" audience responses.

5. The "burial effect" can be utilized in a pretest of opinion toward an issue-statement so that a parallel form of the same issue-statement will reflect post stimulus opinion without having been significantly affected by the administration of the pretest.

6. Remote audience ratings of speeches appear to correlate positively with the degree to which the remote audience has been influenced by a given stimulus. However, remote audience ratings of speakers in this study did not correlate consistently with the degree to which the audience had been influenced. Speaker and speech ratings as a method of determining the degree to which opinion may have been shifted would not appear to be highly reliable.

7. The superiority of the Rally-originated political address appears to be well enough established, within the limitations and specifications of the experiment conducted, to justify selecting such a presentation when alternatives exist. Remote audiences appear to be affected by bandwagon motivation.

Microfilm $3.25; Xerox $11.20. 251 pages.

THE EMERGENCE OF A CHARACTERISTIC CONTEMPORARY FORM IN THE AMERICAN DRAMA OF TENNESSEE WILLIAMS

(L. C. Card No. Mic 59-389)

Esther Merle Jackson, Ph.D.
The Ohio State University, 1958

This study is concerned with the emergence of a new expressive form in the theatre of the twentieth century, with the rise of an anti-Aristotelian drama which has two significant modes of expression: the French philosophical drama of Giraudoux, Sartre, Anouilh, and Camus, and the American psychological drama of O'Neill, Miller, and Tennessee Williams. These seemingly distinct kinds are aspects of a single development, the maturation of a contemporary art of the theatre, the emergence of a Contemporary form.

The drama of American playwright Tennessee Williams represents a significant level of achievement in the total movement of the Western theatre toward a distinctively modern form. There has developed around this playwright an entire dramaturgy, an art of acting, directing, and production which synthesizes elements of European Modernism with vital aspects of form derived from the dance, from the cinema, and from American letters, especially from poetry and the novel.

The drama of Williams has evolved from a new "sensibility," from a new world-view which this playwright has transposed into the language of the popular American theatre. Williams, like other modern artists, has fallen heir to a new image of man and a new perception of reality. The "divided image" of the new theatrical form owes its existence to the events of history in the modern era and to those explorations in thought which are symbolized by Freud, Bergson, and Einstein.

Williams is, thus, engaged in the same activity which occupies the attention of other artists in the twentieth century. His drama is the imitation of a search for meaning in new experiences; it is the "Odyssey" of modern man, transposed in the complex language of the theatre.

The form which has evolved in the new theatre of Williams and others is synthetic. Williams, like other dramatists in the genre, seeks to reconcile the increasing conflict in modern existence through art, through unification by formal design. To this end, he evolves a myth of contemporary man, a symbolic structure created from fragments of ideas, "partial perspectives." This poetic construct, which serves as a language for the explication of theme, is composed like a collage; it is pieced together from perspectives associated with Freudianism and Existentialism, with American literary history, and with the traditions of the theatre itself.

We may describe the form of Williams in Nietzschean terms, as an attempt to unify the Dionysian and Apollonian modes of consciousness within the theatrical form. Despite this intent, the drama of Williams and others does not achieve an organic unity, the reconciliation of tensions within the form. The Glass Menagerie, A Streetcar Named Desire, Summer and Smoke, and Camino Real retain a fundamental internal antagonism, an inner conflict between experience and reflection, poetry and logic, appearance and reality. The drama does succeed in achieving an outer synthesis, a unity based on the creation of a complex medium, a new instrument which the playwright describes as

"Plastic Theatre." Through this complex expressive medium, the synthetic theatre of Gordon Craig, Appia, and Wagner, the dramatist is able to re-create his vision of humanity in its present dilemma.

The drama of Tennessee Williams is not an accidental phenomenon in the history of the theatre. It is an outgrowth of a new poetic apprehension which the playwright has transposed into the language of the American popular arts. Williams, in his major work, has made a significant contribution to a rapidly maturing form.

Microfilm $2.00; Xerox $7.00. 150 pages.

THE ORIGIN AND DEVELOPMENT OF RADIO BROADCASTING AT THE UNIVERSITY OF WISCONSIN TO 1940

(L. C. Card No. Mic 59-1405)

John Stanley Penn, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor H. L. Ewbank

The radio broadcasting activity of the University of Wisconsin has long been regarded as a vital factor in the educational and cultural pattern of the state. Today, it is so well established that little attention is devoted to its origin and development.

This study records the history of the oldest radio station in continuous operation in the United States. It appraises the motives, objectives, work, and accomplishments of those responsible for this enterprise. It examines the conditions, forces and problems involved in the development of the station and its concept of educational broadcasting. It brings into focus the role of this pioneer university station as it exemplifies the growth, difficulties, achievements, and contributions of educational radio in the nation.

Wisconsin radio was originated by Professor Earle M. Terry, a physicist with a social concept. He began broadcasting weather information by wireless telegraph in 1916, some five years before the communications industry recognized the broadcasting potential of wireless. His experimental activity by governmental designation throughout the war period, when all wireless apparatus was dismantled by federal order, facilitated the development of wireless telephony at Wisconsin. In early 1919, broadcasting by this method became a reality for the Terry-built station.

During the immediate post-war period, before commercial broadcasting came into existence, Wisconsin radio formulated some fundamental concepts of educational broadcasting. The pioneers envisioned radio as a medium to serve the public, to provide cultural and informational programs and to contribute to the public good.

Many university stations were established in the decade of 1920-1930, but few survived the burgeoning growth of commercial broadcasting and academic apathy. In its struggle to endure, the Wisconsin station developed educational programming and operational policies. By the early 1930's, her leadership in educational radio was becoming recognized.

Wisconsin has evolved the following concepts of educational broadcasting:

1. It has a responsibility to carry the resources of the university to the people of the state.
2. It is necessary to keep this medium of mass communication free from monopolistic domination.
3. It should serve the public.
4. It has a responsibility to broadcast to various and specific audiences.
5. It has an obligation to provide a free forum for discussing public issues.
6. Cultural and informational programs are the core of educational programming.
7. Public school education can and should be supplemented by the educational station.
8. It should stimulate demand from listeners for better quality programs from commercial broadcasting.
9. Research on broadcasting is a requisite function of university radio.

This study brings together information from the private papers of the men who built Wisconsin radio; communications from many who were associated with the early activity; interviews with surviving leaders of the project; the official university records; the files of the station; newspapers of the campus, city and state; and the literature on the history of radio. From these sources, it records the development of the oldest pioneer which rose to leadership in educational radio broadcasting.

Microfilm $6.45; Xerox $22.20. 505 pages.

EVIDENCE, ARGUMENT AND DECISION IN BROWN v. BOARD OF EDUCATION

(L. C. Card No. Mic 59-587)

David Boyd Strother, Ph.D.
University of Illinois, 1958

The Supreme Court's pronouncement on May 17, 1954, declaring separate educational facilities inherently discriminatory and, therefore, in violation of the Fourteenth Amendment, resulted from hearings on four cases, Brown v. Board of Education, Briggs v. Elliott, Davis v. County School Board, and Gebhart v. Belton.

The purpose of this study was to analyze the evidence, argument and decision, from approximately 6,000 pages of official court documents, in the school segregation cases, both in the lower courts and in the Supreme Court. In the lower courts, litigation centered around three issues: (1) in contravention of the Fourteenth Amendment, educational facilities provided Negroes are unequal, (2) in contravention of the Fourteenth Amendment, segregated educational facilities cause Negroes to suffer irreparable injury, and (3) the courts should abolish state segregation statutes. In the Supreme Court, a fourth issue emerged, which could only occur in an appellate court, the lower courts erred in upholding the states' segregation statutes.

In argument under the first issue, plaintiffs presented testimony from educators who brought forth specific items of substantial physical inequalities. In two cases, the defendants admitted that inequalities existed and, in the other two cases, they attempted to convince the courts that facilities were substantially equal. In only one of the cases, however, were they successful. Inequality of facilities was

not at issue before the Supreme Court because steps had been or were being taken to equalize.

In argument under the second issue, plaintiffs presented testimony from social scientists who contended that separation irreparably injured the Negro's potential to learn. In all four cases, the defendants considered the issue irrelevant to the litigation and, with the exception of one case, presented no counter argument. In one case, the lower court threw out the issue as irrelevant. In another, where the defendants presented expert witnesses in counter argument, the court refused to rule. And in two cases, the courts acknowledged the validity of the plaintiffs' argument, but felt compelled to rule on the basis of "tangible" inequalities, in compliance with the Plessy doctrine of "separate but equal." In the Supreme Court, there was little argument on the inherency of discrimination in segregation, although it was on this issue that the Court ultimately abolished state segregation statutes.

In argument under the third issue, the plaintiffs contended that decisions of the Supreme Court, in recent cases involving segregation in graduate and professional schools had whittled away the Plessy doctrine. The defendants, however, maintained, and the lower courts agreed, that the Supreme Court had not overruled the Plessy doctrine.

In the first hearing before the Supreme Court, the litigants generally reviewed their stand on the issues in the lower courts. On reargument, debate was limited to answering questions propounded by the Court seeking to learn the understanding toward segregation of the framers and ratifiers of the Fourteenth Amendment, whether the Court had jurisdiction to abolish state segregation statutes, and the kind of relief which ought to be granted should the Court void them. In its opinion, the Court concluded that the intent of the framers and ratifiers of the Amendment was inconclusive, and it assumed jurisdiction to review the Plessy doctrine on the basis of the Court's interpretation of the Slaughter House Cases, in 1869, and Strauder v. West Virginia, in 1880, in which equality of rights under the Fourteenth Amendment was broadly defined. The questions regarding implementation were postponed for reargument.

After a systematic pairing of all of the arguments, this conclusion became evident:

The strongest argument of the school boards was the impracticability of desegregating schools. The plaintiffs strongest argument dealt with the injustice of the act of segregation. And neither argument was satisfactorily answered. The Supreme Court later ruled that segregation was unjust and ordered desegregation as soon as "practicable." In solving one problem, another was created.

Microfilm $2.60; Xerox $9.00. 200 pages.

THE RADIO AND TELEVISION SPEAKING OF DOUGLAS MCKAY AND WAYNE MORSE IN THE 1956 OREGON SENATORIAL CAMPAIGN

(L. C. Card No. Mic 59-1185)

Duane Emery Tucker, Ph.D.
The University of Wisconsin, 1959

Major Professor: Dr. H. L. Ewbank

This study is an analysis of the role and quality of broadcasting in the 1956 campaigns of Senator Wayne Morse and former Secretary of the Interior Douglas McKay. It deals with both the primary and general election campaigns and includes an analysis of broadcasting by McKay's primary election opponent, Philip Hitchcock.

The study is concerned with two major problems: 1) What role did television and radio play in each candidate's total campaign? Did broadcasting, particularly television, significantly affect the relative reliance placed on more traditional methods of political persuasion? 2) Which candidate, Wayne Morse or Douglas McKay, made the more effective overall use of the new medium of television combined with radio, and which one was the more effective speaker on screen and loudspeaker?

The principal procedure employed is that of qualitative rhetorical criticism. The strategies of the campaigns as a whole are reported and several representative television and radio speeches implementing those strategies are analyzed in detail. The speeches are evaluated on the basis of specific purpose and the techniques of persuasion used to achieve it. Judgment is also made of their intrinsic rhetorical worth with attention to substance, organization, style of language and delivery.

The study is based principally on primary source material gained from firsthand contact with the candidates and their campaign staffs. It includes rhetorical criticism by professional students of public address and broadcasting in Oregon.

Criticism of the speeches is set against a background of the nature of the Oregon audience, the climate of political opinion, and the attitudes of the people toward the candidates.

The relative effectiveness of the Morse and McKay campaigns is assessed as to: 1) The grand strategy; 2) the use of the media to communicate it; and 3) the performances of the candidates on the air with emphasis on television. In all three aspects the Morse broadcast campaign was found to be the more effective.

Embodied in the general evaluation that Morse was more effective as a television speaker are these conclusions:

1. Neither candidate was as effective on the air as in the public speaking situation, particularly when placed in the mold of the five-minute scripted television talk.
2. The principal advantage Morse held was his ability to extemporize certain programs.
3. When the candidates are compared on five-minute, written television talks, it is primarily the vocal and visual attributes of delivery that give Morse superiority. The quality of composition of both the Morse and McKay talks was high, style being generally better than invention in McKay's, the reverse in Morse's.

These conclusions lead to four more which are perhaps the major implications of the 1956 Oregon senatorial campaign for political broadcasting:

1. The successful use of television demands the "ready-made" television personality or one who can feasibly be trained rapidly for the medium.
2. Where the candidate has television potential but a background of public speaking experience, his talents must be adapted to the television campaign and

the campaign designed to fit the nature and extent of his adaptation.

3. As long as political broadcasting must compromise serious content for the sake of appeal to an entertainment-oriented audience it can never substitute for the stump speaking campaign in developing any but a superficially-informed electorate.

4. The Morse-McKay contest is evidence that the candidate who fears his opponent will use every avenue to the voter he can finance, however high he rates the power of television to inform and persuade. The problem the candidate faces is not so much one of deciding which medium to de-emphasize or eliminate in favor of television, but how best to exploit its great potential.

Microfilm $5.10; Xerox $17.00. 399 pages.

ZOOLOGY

FECUNDITY AND DEVELOPMENT OF THE MEXICAN BEAN BEETLE AS INFLUENCED BY VARIETAL DIFFERENCES IN BEANS

(L. C. Card No. Mic 59-345)

William Vernon Campbell, Ph.D.
North Carolina State College, 1958

Supervisor: Dr. Charles Henry Brett

Forty-three varieties of snap beans and 17 varieties of lima beans were field-tested for their resistance to the Mexican bean beetle, Epilachna varivestis Mulsant, in two locations in North Carolina for three years. During these investigations, some varieties of snap beans exhibited 40 to 60 per cent less injury than other varieties. Varieties consistently exhibiting low injury were designated as resistant. The resistant snap bean varieties were Idaho Refugee, Refugee No. 5., Wade, Logan, and Black Valentine. Refugee type beans have also been reported as resistant to leafhoppers and bean weevils. The most susceptible varieties were State, Spartan, Bountiful, Dwarf Horticultural, and King Green.

Lima bean varieties designated as resistant were Triumph, Evergreen, and Henderson. The most susceptible varieties were Clark, Cangreen, Woodruff's Prolific, and Burpee's Improved. Lima beans generally showed more tolerance to injury than snap beans.

Nine varieties of snap beans and nine varieties of lima beans were selected for a more critical study of resistance and some of the factors associated with resistance. These selected varieties represented three resistance categories, viz., resistant, intermediate and susceptible.

The rate of development of beetles reared on resistant varieties was not different from the rate of development on susceptible varieties. The fecundity or reproductive capacity of females reared on resistant varieties was significantly reduced. Only half as many eggs were laid by females reared on the resistant varieties as compared with those reared on the susceptible varieties.

Females reared on resistant varieties appeared smaller. The weight of laboratory-reared and field-reared beetles confirmed this observation. Females reared on resistant varieties weighed significantly less than females reared on susceptible varieties.

Leaves of the various bean varieties were observed to differ markedly in their shape, size, surface texture, veinal structure, and thickness. Anatomical studies were instigated to determine if foliage characters were associated with resistance. Results obtained from secondary and tertiary vein counts indicate resistance is associated with more numerous or more closely spaced veins. These results were significant for both snap beans and lima beans.

The minute anatomy was studied by means of histological sections. These transverse leaf sections were stained and photomicrographs were taken of most varieties. Results indicated resistance of snap beans to the Mexican bean beetle was associated with the thickness of tertiary veins, a greater ratio of cells to air space in the sponge, and with the length of epidermal hairs. Resistance was not significantly associated with total leaf thickness, thickness of either epidermis or the number of hairs and glands. Resistance of lima beans was significantly associated with total leaf thickness, tertiary vein thickness, and the length of hairs.

Paradermal sections provided additional information on the spacial arrangement of the spongy mesophyll cells and the relative ratio of cells to air space. Resistant varieties had significantly more cells and significantly less air space than the susceptible varieties.

In final summary, resistant bean varieties are less preferred, they reduce the fecundity of the bean beetle, they reduce the weight and size of females, and they exhibit a greater tolerance to injury.

Microfilm $3.05; Xerox $10.60. 236 pages.

A STUDY OF THE EFFECTS OF INFRARED AND X-RADIATION ON A TRANSPLANTABLE MAMMARY TUMOR IN MICE

(L. C. Card No. Mic 58-5122)

Gordon Murray Clark, Ph.D.
Emory University, 1954

In this investigation the effects of radiation on a rapidly growing transplantable mouse mammary tumor were studied. Infrared was given both continuously and fractionally. X-radiation was given in massive doses and in fractional doses. Combined fractional infrared and X-radiation was also employed.

Tumor transplants were made with the use of a glass

pipette and the tumor transplanted subcutaneously in the right axillary region of the animal. Some 340 mice received transplants in the course of the investigation. Tumors were treated one week to ten days after the start of the experiment. Tumors were measured and animals weighed at periodic intervals during the experiment.

A source of filtered infrared in the spectral range of 10,000 Å was obtained by passing light from a standard industrial G.E. 250-watt lamp through a one cm thickness of an iodine-saturated carbon tetrachloride solution and through a water cooling bath one inch in thickness.

Total body exposures of filtered infrared of 36, 60, 72, 84, and 108 hours fractionated as well as 36, 60, 72, 84, and 108 infrared given continuously was used. Fractionated infrared was given with an initial pretreatment of 24 hours with the remaining dosages being given at 12 hours per day on successive days until the total dosage was obtained. In addition one group in the fractionated infrared series was given a total of 101 hours, administered for 19, 20, 24, 19, and 19 hours per day on successive days.

Lower dosages in both the continuous and fractionated infrared series of 36, 60, and to some extent 72 hours had a possible stimulatory effect on the tumor. Controls on the average lived from three to five weeks before death ensued.

At higher dosages in the infrared, both continuous and fractionated, more tumor regressions were reported. At 108 hours fractionated infrared five of the ten animals showed regressions as opposed to four of the ten in the continuous group. Tumors at these higher dosages showed, upon gross examination, an extreme necrosis of the central portion of the tumor. This was not noticed in comparable control tumors.

In X-radiation studies on this tumor a G.E. machine OX-250 with a medical type tube S.R.T.-2 operating at 250 kv, 15 MA and having an inherent filtration of 3 mm of Al. was used. An additional 2 mm of Al. was used for filtration. All deliveries were made at 75 r per minute.

The animals were anesthetized previous to irradiation using aqueous pentobarbitol sodium (Abbott) at a dose equivalent to 3 mg per 100 grams body weight. Animals were shielded using three-eights of an inch of lead and only the tumor and a portion of the body wall were exposed to the X-radiation.

Point or spot X-radiation on the tumor consisting of a single massive dose of 525 r, 1050 r, 1575 r, and 2100 r was used. In addition fractionated dosages were given as follows: an initial dose of 375 r and doses of 37.5 r on successive days for a total dosage of 525 r; an initial dose of 750 r with 75 r given on successive days for a total of 1050 r; an initial dose of 1125 r and 112.5 r each day following for a total dosage of 1575 r; 2100 r consisting of an initial dose of 1500 r with 150 r given on successive days for a total of 2100 r and an initial dose of 1875 r with 187.5 r given on successive days for a total dosage of 2625 r.

With the use of a single massive dose no regressions were recorded. However, only a few tumors received such treatment.

At 2625 r fractionated X-radiation, 100 per cent tumor regressions were found with a decreasing number of regressions at 2100 r, 1575 r, 1050 r, and 525 r. At 525 r some possible stimulatory effect on the tumors was seen. Tumors in this group showed an apparent necrosis in several cases.

In combined treatments with infrared and X-radiation both were fractionated. The infrared pretreatment preceded the initial high dosage of X-radiation in all cases. The following combined radiation treatments were used.

(a) X-radiation of 2100 r combined with 92 hours fractionated infrared

The fractionated X-radiation was given at an initial dosage of 1500 r with four additional doses of 150 r given on successive days for a total of 2100 r. The infrared was given at 12, 19, 20, 24 and 19 hours per day. The 12 hours infrared was given previous to receiving the initial dosage of 1500 r. Six of the eight animals, bearing tumors, treated with combined radiation were classed as regressions.

(b) X-radiation of 1050 r combined with 72 hours fractionated infrared

The fractionated X-radiation was given at an initial dosage of 750 r with four additional dosages of 75 r for four successive days for a total of 1050 r. The infrared pretreatment of 24 hours was given previous to the initial high dosage of 750 r. For the remaining four days the infrared was given for 12 hours per day followed by the X-radiation dosage of 75 r. Five of the six animals at the end of the experimental period showed tumor regressions.

(c) X-radiation of 1050 r combined with 108 hours fractionated infrared

The 1050 r X-radiation was given as previously described. The infrared was given as a 24 hour pretreatment to the initial dosage of 750 r with an additional 21 hours a day infrared given on four successive days along with 75 r per day. Nineteen animals with tumors were used in this group, fifteen of which showed regressions.

Gross examination of tumors in these combined treatment groups showed an apparent necrosis of the central portion of the tumor. This was particularly marked in the latter treatment, 1050 r of X-radiation and 108 hours of infrared.

Two animals from each of the fractionated X-radiated groups of 525 r, 1050 r, 1575 r, 2100 r, and 2625 r as well as two from the 1050 r and 108 hour combined treatment group which had shown regressions, received additional transplants which grew in all cases.

Microfilm $2.00; Xerox $5.80. 117 pages.

A LIFE-HISTORY STUDY OF THE BRONZED GRACKLE, QUISCALUS QUISCULA VERSICOLOR VIEILLOT

(L. C. Card No. Mic 58-2323)

Lester Emery Eyer, Ph.D.
Michigan State University, 1954

The life history of the bronzed grackle, Quiscalus quiscula versicolor, was the subject of intensive study in the vicinity of East Lansing, Michigan, during 1951 and 1952. Emphasis was placed on the nesting cycle, particularly of those birds breeding in marshes and swamps. Other phases of the study included: (1) post-nesting activities of family

groups, (2) the development of hand-reared birds kept in captivity for a year, (3) food habits, based on the analysis of 20 stomachs and supplemented by a review of the literature, and (4) roosting and flocking of grackles in mixed flocks of starlings and cowbirds in willow-thicket and maple-tree roosts. As a secondary objective the literature was reviewed for: (1) the complicated history of the taxonomy and nomenclature of the genus Quiscalus, (2) the distribution and migration of the species quiscula, supplemented by unpublished return records of 52 grackles banded in the vicinity of East Lansing.

The nesting cycle. Male grackles arrive in southern Michigan about mid-March. Courtship begins when the females arrive from 6 to 10 days later. In selecting a mate two to four males compete for a single female by: (1) performing intimidation displays, e.g., bill-pointing and a challenge song accompanied by a roughed-feather display, and (2) accompanying the female in short flights away from the nesting area. The dominant male becomes the mate after a week or so of competition. No definite territorialism is evident.

In early April the female, accompanied by her mate, begins hunting for a nesting site in the marsh. About mid-April the female starts the nest, while the male guards. Nest building is usually completed in two weeks.

A survey of nesting sites in a 12-square-mile area revealed: (1) that about half of the population nested in marshes and swamps and half in coniferous trees, (2) that the average size of the marsh colonies was 6 pairs, while that of the coniferous-tree colonies was 915 pairs, and (3) that the population was 12.3 grackles per square mile.

Incubation, carried on by the female only, begins nearly three days after the nest is complete and lasts for an average of 12.7 days. Both male and female feed the young, but only the female broods.

Out of 33 active nests the survival rate was 1.2 young per nest. Two important mortality factors were bad weather (23 per cent of eggs deserted) and predation (20 per cent by natural enemies, 6 per cent by the investigator).

Hand-reared birds. The young male began to "sing" following the postjuvenal molt, but the females did not start singing until December. The song of a mature bird was not attained by the captive young. Although the females begged and postured before the male, copulation was not observed. In May one female showed signs of nest building--she picked up bits of string, grass and other material available within the cage.

Roosting. Before nesting both male and female grackles roosted in a willow thicket with starlings, cowbirds, and red-wings. (The roosting population, however, was predominantly starlings.) But as soon as incubation was started, the females roosted on the nests while the males continued to use the same willow-thicket roost.

Microfilm $2.80; Xerox $9.60. 213 pages.

STUDIES ON THE IN VITRO SURVIVAL OF LARVAL STAGES OF THE TREMATODE, FASCIOLOIDES MAGNA, WITH ANALYSES OF THE HEMOLYMPH AND TISSUE CULTURE OF A SNAIL HOST, LYMNAEA STAGNALIS

(L. C. Card No. Mic 59-1264)

Frank Edward Friedl, Ph.D.
University of Minnesota, 1958

Cultivation of snail host tissues, analyses of hemolymph, studies of the parasitic infection, and trials of various media on the in vitro survival of rediae have been drawn together to gain knowledge pertinent to the eventual cultivation of larval stages of Fascioloides magna on artificial media.

Snail amoebocytes exhibited motility and would survive for 60 days in hemolymph plus 1% maltose. Heart tissues and some duct tissues appeared to "heal" themselves and subsequently produce bulbous swellings. Heart muscle would contract up to 40 days, foot muscle up to 18 days. Ciliated epithelium was active for 27 days. Best culture survival was obtained using snail hemolymph or Carriker's physiological salt solution designed for Lymnaea as basic media. No proliferation was noted, and tissues such as liver, ovotestis, and mantle were refractory to culture or did not exhibit any changes.

Analyses of the hemolymph of Lymnaea stagnalis showed: 98.1% volatile material, 1.98% organic material, .402% ash, specific gravity 1.0041, and pH 7.9. Sodium, potassium, calcium, and magnesium are present with .183, .0097, .028, and .005 gm of the respective ion in 100 gms hemolymph. In terms of glucose, sugar was present at 56.3 gammas/ml by chemical test and 59.4 gammas/ml by fermentation. Total protein nitrogen was about 428 gammas N/ml. Hemolymph protein precipitated with ammonium sulfate could be redissolved in water; protein precipitated with ethanol was insoluble. Ultracentrifugation of hemolymph protein showed three peaks. Non-protein nitrogen samples probably indicate about 150 gammas N/ml. Circular paper chromatography gave evidence of alanine, aspartic acid, leucine, proline, serine, and valine. Spectrophotometric studies showed the absorption of hemocyanin and that of a yellow substance, possibly derived from the liver.

Embryonated ova of F. magna could be induced to hatch if subjected to a reduced atmosphere of 15-20 cm Hg at room temperature in the light. Rediae appear to develop primarily on the larger sinuses of the mantle, foot, and visceral regions. Host tissue destruction appeared minimal; although some infections resulted in cercarial development and release, many old ones gave evidence of abortive redial development.

Of the physiological salt solutions tried in the survival studies of rediae, Clark's solution, originally designed for insect tissue culture, was the most suitable for general use at pH 7.0. Antibiotics are tolerated to 800 units/ml of penicillin and streptomycin together. Glucose and fructose exhibited no effect on survival time, as did none of nine commercially available complex media. Worms added to an agar slant medium containing rabbit blood with an overlay of neopeptone broth showed no significant increase in survival time either alone or containing cultured flagellates. Autoclaved snail hemolymph extended survival to 13 days, far in excess of any other medium tried. The

amino acids, alanine, hydroxyproline, proline, and serine gave longer survival times than controls. Aspartic and glutamic acids, histidine, phenylalanine, and tryptophane reduced survival, and arginine, cystine, cysteine, glycine, isoleucine, leucine, lysine, methionine, threonine, tyrosine, and valine appeared indifferent. The amino acid amides asparagine and possibly glutamine lengthen survival, but the tripeptide glutathione reduces it.

The possible significance of the results of the survival studies are discussed in relation to the metabolism of the rediae and the character of the host-parasite relationship.

Microfilm $2.55; Xerox $8.80. 193 pages.

PURIFICATION, ISOLATION AND DESCRIPTION OF CYTOPLASMIC GRANULES AND PARTICULATES ASSOCIATED WITH GONADOTROPIC HORMONES OF THE ANTERIOR PITUITARY GLAND OF THE RAT

(L. C. Card No. Mic 59-1392)

Marshall Wendell Hartley, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor W. H. McShan

The objective of this research has been to isolate a fraction which contains a single cytoplasmic constituent with which the major portion of the gonadotropic hormone activity is associated.

Anterior pituitary glands from rats castrate for 8 weeks were homogenized in a 0.25 M sucrose-7.3% PVP (polyvinylpyrrolidone) solution and fractionated by differential centrifugation to give a heterogeneous small granule fraction which contained the major portion of the gonadotropic hormone activity. The active supernatant which contained the small granule fraction was separated into layers by isopycnic gradient centrifugation on a 6-45% sucrose-17.5% 'Diodon'-$5 \cdot 10^{-4}$ M 'Versene' gradient at 100,000 g. for 2 hours.

The active pellet obtained from the S_2E layer was sectioned and examined with the electron microscope and was found to contain 200 mμ osmophilic granules, mitochondria, ergastoplasm and other cellular debris. The S_2E layer was fractionated further by isopycnic and differential centrifugation to obtain a pellet which contained a major portion of the gonadotropic hormone activity. Because of the heterogeneity of this fraction, due to contamination of the 200 mμ granules with mitochondria and other cellular debris, the method of microfiltration was applied to obtain a homogeneous granule fraction.

The active S_2E layer and the resuspended active pellet obtained by centrifuging the S_2E layer first at 17,000 g. then diluting the supernatant and centrifuging at 30,000 g. for 1 hour were filtered through Millipore HA paper with a pore size of 0.45 μ. The cytoplasmic material containing the gonadotropic hormone activity passed through the filter paper and was recovered in the pellets by centrifuging at 100,000 g. for 1 hour. These active pellets consisted almost entirely of 200 mμ granules with a minimum amount of contamination and they contained the major portion of the gonadotropic hormone activity with practically none remaining in the supernatant fractions.

These results indicate that the gonadotropic hormone is associated with the 200 mμ osmophilic granules. They also support the hypothesis based on electron microscopic studies, that the cells in the anterior pituitary of the rat which contain granules 200 mμ in diameter produce and secrete gonadotropic hormones. The apparatus and procedures developed in this study can be adapted for research on isolation, and localization of other hormones in the pituitary gland.

These relatively pure 200 mμ granules with which a large amount of gonadotropic hormone is associated, are suitable for use in the study of the physical, enzymatic and chemical properties of these granules. The results from this type of experimentation should be of value in the determination of the role of the granules in the production, storage and secretion of gonadotropic hormones.

A comprehensive review is presented on current views of the pituitary cell types and their secretions in the rat as determined from histochemical and electron microscopic studies. Microfilm $2.00; Xerox $7.00. 149 pages.

A STUDY OF HYBRIDIZATION AND HETEROPLOIDY IN TWO SUBSPECIES OF TRITURUS VIRIDESCENS

(L. C. Card No. Mic 59-460)

Walter Norman Hughes, Ph.D.
Emory University, 1958

Supervisor: Asa A. Humphries, Jr.

One of the most fruitful paths of research into the problem of the relative importance of the nucleus and of the cytoplasm in development is the experimental alteration of the normal nucleo-cytoplasmic relationship and observation of the effects of this alteration on development. In this work, both qualitative (hybridization) and quantitative (heteroploidy) alterations in eggs of Triturus viridescens viridescens and Triturus viridescens louisianensis have been produced.

The normal development of the two subspecies is alike in most respects. The first observable difference is in the pattern of pigmentation. Soon after the melanophores appear in louisianensis (7 days), they begin to align themselves into a black continuous band in the dorso-lateral region of the body and into two longitudinal stripes on each side of the head. In viridescens, on the other hand, the melanophores are more randomly distributed, giving the animals a rather mottled appearance. During the later development (25-30 days), the melanin becomes concentrated within the central part of the pigment cells and the larvae are then covered by tiny black spots, which are irregularly round in louisianensis, and spidery in shape in viridescens. The only additional difference found in the development of these two forms is that the hindlimb appears earlier in viridescens than in louisianensis. The fact that the stage of development of the forelimb in the two forms is different when the hindlimb first appears indicates that this is actually a variation in synchrony of development rather than merely a difference in speed.

Diploid hybrids, which were produced through artificial insemination, demonstrated a pigment pattern more

nearly like that of louisianensis. Reciprocal hybrids were alike with regard to pigmentation, but not in the time of appearance of the hindlimb. The hybrids resembled the maternal parent in the time of hindlimb appearance.

Heat shock following heterospermic insemination was used to produce triploid hybrids. Such hybrids have two sets of maternal chromosomes, since the heat shock suppresses the formation of the second polar body. Although triploids have larger and fewer cells, those with two louisianensis genomes have about the same pattern of pigmentation as do diploid hybrids. The reciprocal triploids, however, are more like the viridescens type than are diploid hybrids.

The additional set of chromosomes in the triploids did not affect the time of appearance of the hindlimb. Larvae developing from viridescens eggs showed the anlage of this organ at the same average age regardless of whether they were diploid or triploid. The hindlimb also appeared at the same average age in diploid and in triploid hybrid larvae from louisianensis eggs. This is evidence of a maternal effect in this characteristic, and is most reasonably explained by postulating that the factors which are primarily responsible for the time of hindlimb appearance act at an early stage, perhaps before fertilization.

Three methods were used in attempts to obtain embryos with diploid nuclei of one subspecies in cytoplasm of the other. One of these methods was nuclear transplantation. Nuclear transfer from blastulae into enucleated eggs has been successful in frogs' eggs, and to a lesser extent, in newts' eggs. The application of this technique to the problem at hand has not been successful, but probably can be accomplished with more attempts. The other two methods were designed to block the first cleavage division of androgenetic eggs with the intention of doubling the haploid set of chromosomes. Androgenetic eggs were produced by mechanical removal of the egg nucleus, and blockage of the first cleavage was attempted by heat shock and by colchicine. Neither was successful in our experiments, and results of other workers indicate that colchicine probably is not useful for this purpose. Heat treatment, however, probably is useful, since tetraploids have been produced by such a treatment of diploid frog eggs. Nuclear transfer and heat shock at the first cleavage division certainly warrant further attempts, since either of these would give the ultimate in an atypical nucleo-cytoplasmic combination: a diploid set of chromosomes of one subspecies in the cytoplasm of another.

Microfilm $2.00; Xerox $4.00. 73 pages.

THE EFFECT OF LITHIUM CHLORIDE ON THE DEVELOPMENT OF NASSA OBSOLETA, A MARINE GASTROPOD WITH MOSAIC DEVELOPMENT

(L. C. Card No. Mic 58-5151)

William Dixon Ivey, Ph.D.
Emory University, 1955

Chemical modification of development has occupied the attention of numerous investigators since 1892 when Herbst reported that lithium ions could cause vegetalization in sea urchin eggs with a resulting exogastrulation in some cases. Amphibians, fishes, a bird, and cephalopods have been investigated. However, the effects of lithium have been studied in only a few mosaic eggs (a pulmonate, an annelid, and several ascidians). The present study concerns the morphogenetic effect of lithium ions on the mosaic eggs of Nassa obsoleta Say (Ilyanassa obsoleta Stimpson), a marine gastropod.

A total of 19,600 eggs in 335 capsules were subjected to lithium treatment. The eggs were treated in their capsules with 0.0125 M - 0.6 M solutions of LiCl in sea water. The greater part of the work was done with 0.2 M, 0.1 M, and 0.05 M solutions. Treatment was begun at various stages of development from just after laying to about 72 hours of age. Duration of treatment was from 30 minutes to 24 hours in most cases; a few capsules were treated continuously until time of hatching.

A total of 3,143 control eggs were reared, of which 91.2% developed into normal veliger larvae. Most of the abnormal veligers in the control series were in two of the 51 capsules; if these are excluded, 97.1% of the remainder were normal. Normal variations of the veliger larvae included size and amount of pigmentation.

A short series of tests with hypotonic and hypertonic sea water indicated that tonic effects of the test solutions were of little, if any, importance in producing the results presented in this study.

All developmental stages from the time of laying until about 48 hours were sensitive to lithium ions. Solutions of 0.2 M LiCl usually produced a slight slowing of the cleavage rate; 0.4 M solutions produced a pronounced slowing of cleavage; 0.6 M solutions, acting for 30 minutes, produced resorption of the polar lobe and cessation of cleavage. Where cleavage was not blocked development often ceased at the gastrula stage. Treatment with 0.2 M LiCl for 8 hours, 0.1 M LiCl for 24 hours, and 0.05 M or 0.025 M LiCl continuously usually arrested development at the gastrula stage. In some cases gastrulae fused either in pairs or in masses of several individuals.

Ectodermal derivatives were studied in detail in those larvae which developed past the gastrula stage. The degree of interference with development depended primarily on the concentration of lithium solutions and duration of treatment. Abnormalities were produced by treatment with LiCl in concentrations as low as 0.0125 M. There was some indication that the eggs were more sensitive to lithium solutions around the time of appearance of the 4d cell.

The shell seemed to be the structure most susceptible to treatment with lithium. In the control series, 7.1% had shells reduced or absent. The anterior extension of the shell in lithium-treated larvae frequently was incomplete while the posterior end seemed normal; in other cases the shell was absent. In a few cases the shell was distorted into a strap-like structure. One or more yellow hyaline masses appeared in some of the veligers with shell abnormalities, but only in those with reduced shells. Another shell abnormality, which appeared independently of the reduction in size, was a straight shell or one curved only about half as much as normal. Abnormal torsion of the animal in relation to the shell occurred frequently when the shell was straight or only slightly curved.

Supernumerary eyes, a rare anomaly in the control series (4 out of 3,143 cases), were common in lithium-treated embryos. Some treated veligers had as many as nine pigmented spots which were identified as eyes.

A lower incidence of treated larvae lacked eyes altogether.

A ciliated cyst in the head region, usually near the mouth, appeared frequently as a result of lithium treatment. It consisted of a layer of cuboidal or low columnar cells and contained a few mesenchymal cells. The cavity of the cyst was continuous with the head cavity. The cyst varied in size from a small round structure to one as large as the rest of the embryo. This abnormality appeared most frequently after treatment during gastrulation and was the only anomaly encountered which was produced regularly by treatment at a specific stage. Only four of 3,143 control veligers had a similar cyst.

Abnormalities of the foot and velum were relatively rare and did not occur in the controls. In a few veligers the operculum was one and one-half to three times longer than normal. In several veligers the foot appeared as a swollen knobby mass. In two embryos three velar lobes were present.

Few detailed observations were made of endodermal structures because of the difficulty of studying these in the living veligers. It can be stated, however, there was no enlargement of the endoderm; instead there seemed to be a generalized inhibition of endodermal development.

Assuming the cell lineage in Nassa to be essentially the same as that of Crepidula and other gastropods, the results obtained in this study do not indicate any generalized depression by lithium of an "animalizing gradient" such as has been reported for the echinoderm egg. The shell (from the 2d cell) and the eyes (from the first quartet) were the most susceptible structure. Other organs derived from the same region of the egg, such as the velum (from the first two quartets) and the foot (from the 2nd and 3rd quartets), were rarely affected. There was, thus no evidence of inhibition of an animal pole gradient as Raven found in Limnaea nor of the vegetalization which occurs in echinoderm eggs. Instead, there seemed to be inhibition of local areas or organ primordia as Henley found in the annelid, Nereis. Exogastrulation was not observed.

Microfilm $2.00; Xerox $3.60. 61 pages.

THE LIFE CYCLE AND PATHOLOGY OF SPIRORCHIS ELEGANS STUNKARD, 1923

(L. C. Card No. Mic 58-5155)

Daniel Eddins Kirk, Ph.D.
Emory University, 1958

In this work, the life cycle was completed and the histopathology and ecology were investigated in Spirorchis elegans Stunkard, 1923, a trematode found in the blood vascular system of turtles. The parasite was found naturally occurring in the eastern painted turtle, Chrysemys p. picta (Schneider), in DeKalb County, Georgia. Miracidia were hatched from eggs contained in lung tissue, and young snails of the genus Helisoma and adult Menetus dilatatus (Lea) were infected in the laboratory. Cercariae from these snails attacked the head and cloacal regions of eleven young Chrysemys p. marginata Agassiz, five of which subsequently passed spirorchid eggs and contained such eggs in the tissues at post-mortem, and one turtle did not become infected. All of the ten control turtles remained free of evidence of any helminth parasites throughout the experiment. Specimens of Pseudemys elegans Weid were subsequently infected also.

Eggs of Spirorchis elegans are passed in the feces and intestinal mucus of infected turtles. They are broadly elliptical in outline and vary in color from amber to reddish brown. Twelve fecal eggs had a range of 96 to 118 microns in length and 70 to 77 microns in width. Most eggs hatch after four nights of incubation in pond water at summer temperatures. Hatching occurs from 2:00 A.M. to 6:00 A.M. and most miracidia have expired by 9:00 A.M. in summer.

Hatched miracidia are long-oval in shape, and widest at the level of the prominent eyespots. They swim rapidly in short, straight lines, rotating slowly on the long axis. The length of four typical fixed specimens ranged from 71 to 91 microns and width ranged from 37 to 48 microns. Four tiers of ciliated interlocking epidermal plates cover the body. From anterior to posterior, the number of plates in each tier is 6, 6, 4, and 2. Two eyespots, a pair of large cephalic lytic glands, two pairs of flame cells, and a germinal mass were observed in the interior of the body. Cilia cover the body except at the apical papilla and at the plate sutures. All depths of water in a 4" fingerbowl are occupied and no preference for light was shown.

Young Helisoma and Menetus dilatatus of all ages were attacked by miracidia if exposed in early morning. Tentacles of Helisoma and any exposed surface of Menetus were penetrated in as short a time as one minute.

Structures interpreted as young daughter sporocysts were found on snail livers as early as nine days after exposure of the snails. Mature daughter sporocysts are long and unbranched, containing nearly mature cercariae at the distal end and younger cercarial stages proximally. Cercariae began emerging from infected snails in from seventeen to twenty-three days.

The cercaria of S. elegans is apharyngeate, furcocercous, and possesses an oral and a ventral sucker. It swims continuously, body forward, and was not seen to rest until moribund. All depths of water are occupied and no response to light is shown. Maximal cercarial emission from snails occurred from 9:00 P.M. to midnight. Nearly all the cercariae are dead by 8:00 A.M. in summer. Ten formalin-fixed cercariae showed a range of body length of 175 to 224 microns, a tail stem length of 534 to 658 microns and furcal length of 133 to 203 microns. Almost-imperceptible spines cover the body, and a pair of lateral tufts of long, delicate spines is found just posterior to the oral sucker. Two rows of widely spaced lateral spines occur on the tail stem. The furcae possess wide fin folds throughout their length.

Internally, seven pairs of penetration glands occupy most of the posterior half of the body; their ducts run to a pair of pores on the lateral surfaces of the oral sucker. The reproductive fundament lies in the posterior half of the body. Short gut ceca are connected to the oral sucker by a tortuous esophagus. Six pairs of flame cells arranged in the pattern 2[(1+1+1)+(1+1+1)] connect to a Y-shaped excretory bladder at the posterior extremity of the body. The most posteriorly placed flame cell pair lies in the proximal portion of the tail stem. An excretory canal traverses the tail stem, bifurcates at the furcae, and empties by pores at the furcal tips.

Infected turtles pass eggs in the feces seven to ten weeks after exposure to cercariae. Thirteen worms referable to the species Spirorchis elegans Stunkard, 1923,

were recovered from five laboratory infected turtles at post-mortem. Seven worms were found in the heart, four in the brain, one in the brachiocephalic artery, and one in the liver of the turtle hosts. Eggs occurred in every major organ. Most densely occupied sites were the lungs, heart, and the gut wall. The brain frequently contained eggs in the superficial vessels. Sections of organs containing eggs showed the egg surrounded by layers of small round cells, with fibroblasts appearing rarely. The engorgement of lung tissue with eggs, and the delicacy of the epithelium there, suggests the lungs as a possible additional route of egg release from living turtles.

Microfilm $2.00; Xerox $4.80. 95 pages.

THE COMPARATIVE MORPHOLOGY OF THE HYOID IN SNAKES, AND ITS ASSOCIATED MUSCLES

(L. C. Card No. Mic 59-536)

David Lee Langebartel, Ph.D.
University of Illinois, 1958

This study has been made to further the knowledge of variation in the shape of the hyoid apparatus in snakes, and in the musculature associated anatomically and functionally with the hyoid. The "hyoid" is used as a concise term for the tongue skeleton.

Representatives from the following snake families were examined: Anomalepidae, Typhlopidae, Leptotyphlopidae, Uropeltidae, Aniliidae, Xenopeltidae, Boidae, Colubridae, Hydrophidae, Elapidae, Viperidae, and Crotalidae.

The hyoid in snakes falls into four groups by morphology. (1) A modified "M"-shaped type; Anomalepidae. Presumed to be from the second visceral arch only. (2) An inverted "Y"-shaped type; Typhlopidae and Leptotyphlopidae. The process is thought to represent the basihyal of the second arch, and the cornua the first ceratobranchials from the third arch. (3) An inverted "V"-shaped type, or reduction thereof; Uropeltidae, Aniliidae, Xenopeltidae, and Boidae. Apparently the cornua are first ceratobranchials, there being no process. (4) The parallel type; Colubridae and all the poisonous families. The process (basihyal) may or may not be present; the cornua are first ceratobranchials.

The muscles associated with the hyoid are the genioglossus, hyoglossus, ceratomandibularis, geniohyoideus, constrictor colli, neuromandibularis, hyotrachealis, costomandibularis, costocutaneus superior, and transversus branchialis; sternohyoideus and omohyoideus.

The genioglossus, hyoglossus, ceratomandibularis, and geniohyoideus, are from the hypobranchial mass and are innervated by the XIIth cranial nerve. The genioglossus is the tongue protractor. The hyoglossus is the bulk of the tongue. The ceratomandibularis is a ramus-hyoid muscle tending to draw the hyoid anteriorly. The geniohyoideus is found only in anomalepides in snakes; it is a ramus-hyoid muscle.

The constrictor colli and neuromandibularis are from the second arch and are served by the VIIth. The colli is irregular in snakes and always inserts on the hyoid. The neuromandibularis is usually present and insertion is on the ceratomandibular raphe or the jaw.

The hyotrachealis is served by the Xth and retracts the larynx. It is unique to snakes.

The costomandibularis, costocutaneus superior, and transversus branchialis are served by spinal nerves. The first muscle runs from the ribs to the hyoid and the common raphe. With the neuromandibularis and ceratomandibularis it makes up an unique compound muscle which acts to stabilize the hyoid. The second muscle has its anteriormost fibers usually attaching to a fraction of the hyoid. The transversus branchialis is of erratic appearance in snakes. It lies between the cornua.

Analysis of the hyoids and muscles leads to a generalized snake ancestor: second and third arch components in hyoid; hyoglossi divergent; two ramus-hyoid muscles; one or two hyoid-pectoral girdle muscles; costocutaneus superior fibers superficial to hyoid; a cervicomandibularis only; broad, transverse intermandibulars.

There would seem to be three main phylogenetic lines: Anomalepidae on one; Typhlopidae and Leptotyphlopidae on another; remaining snakes on the third.

Typhlopidae and Leptotyphlopidae are considered as being from similar ancestral stock. The Anomalepidae are thought to be not at all closely related to the other snakes.

Tropidophinae is provisionally proposed as a subfamily of the Colubridae. It would include Tropidophis and Trachyboa. Presumably Casarea and Bolyeria may be included here.

Superfamilies provisionally erected are: Typhlopoidea, Anomalepoidea, Anilioidea, Boidoidea, and Colubroidea.

Microfilm $3.00; Xerox $10.40. 231 pages.

EXPERIMENTAL HIBERNATION AND CERTAIN ASPECTS OF THE LIFE HISTORY OF TAMIAS STRIATUS (LINNAEUS)

(L. C. Card No. Mic 59-914)

Joseph Allan Panuska, S.J., Ph.D.
St. Louis University, 1958

Supervisor: Nelson J. Wade

Previous reports on the hibernation of Tamias striatus, often conflicting and indicating a much varied behavior, represent observations on relatively small groups of animals from all parts of the eastern United States. It was desirable to study the hibernation of large numbers from one region. Two hundred and fifty-eight chipmunks were collected at Waupaca, Wisconsin for use in experimentation at St. Louis.

Ecological work at Waupaca complemented the St. Louis hibernation experiments. Burrows were examined in detail. Some burrow systems extended twenty-nine feet and had many chambers and side passageways. None extended below the frost line.

Other field observations were made relative to social dominance, sex ratios, water consumption, weights, the breeding cycle, and possible summer aestivation.

From September until June of four consecutive years, animals were maintained both in open cages and in burrow-boxes under various conditions: in a constant temperature warm room (20° C), in an unheated room (with varying

temperature), in small refrigerators (0-4° C), and in a cold room (1.5° C or 3.0° C). Temperatures of the cold room were lowered gradually over a period of several months.

These experiments demonstrated that Tamias, as a group, has an annual weight cycle in captivity. Cold-exposed groups showed a rise in weight of about 25% from September until January and a comparable drop thereafter even if no hibernation was apparent. The average weight gains of cold-exposed animals were greater than corresponding gains of warm-exposed animals.

Several months of exposure to cold were ordinarily required before any hibernation occurred. Usually a week or two of semi-torpidity (respiration 20-60 per minute) preceded the first torpor (respiration below 20 per minute). Although torpor was frequent, many degrees of activity occurred during the winter season. These ranged from daily activity to torpor for several months, excepting periodic awakenings. During two major refrigeration experiments, 33.3% and 17.5% respectively of cold-exposed animals remained active during the entire ten month periods of exposure. Only semi-torpor was achieved by 31.1% and 17.5% of the animals. Torpor was observed in 35.6% and 65.0% of the animals. The earliest torpor was on December 19th, the latest on June 15th.

Torpid animals usually awakened at least every three or four days; the semi-torpid woke daily. Respiration in torpid animals had a periodicity resembling Cheyne-Stokes breathing. Active cold-exposed animals had body temperatures averaging 37.6 ± 1.53° C; active warm-exposed, 38.5 ± 1.17° C; torpid animals, 6.0 ± 0.77° C. The semi-torpid ranged between these two extremes.

The above results indicate that Tamias frequently attains deep torpor, involving a low body temperature and drastically reduced respiratory rates, and has an annual weight cycle. This animal, therefore, despite its varied behavior, appears to be a somewhat deeper hibernator than has been commonly believed.

Microfilm $2.25; Xerox $8.00. 171 pages.

THE BIOLOGY AND CONTROL OF THE GROUND PEARL EUMARGARODES LAINGI JAK. WITH SOME BIOLOGICAL NOTES ON MARGARODES MERIDIONALIS MORR. (HOMOPTERA: COCCOIDEA - MARGARODIDAE)

(L. C. Card No. Mic 59-353)

William Thomas Spink, Ph.D.
North Carolina State College, 1958

Supervisors: James Russell Dogger and
Clyde Fuhriman Smith

The objectives of this study were to learn something about the seasonal and life histories and control of the ground pearls, Eumargarodes laingi Jak. and Margarodes meridionalis Morr.

The seasonal and life histories were studied by using periodic soil samples taken from the field, and by rearing the insects in the laboratory. From these studies, it was determined that there is only one generation a year of E. laingi. However, in the case of M. meridionalis, there may be only one generation every two years. Only intermediate stages of these insects are in the soil from approximately the middle of August to the middle of May. The various stages of both insects first appear in the soil at the following times: preadults, the latter part of May; live adults, about the same time or a week later; eggs, about the middle of June; and the first instar larvae, or crawler stage, near the end of June. The advanced stage of the first instar larvae of E. laingi appears about the middle of July, and in the case of M. meridionalis it occurs in the soil during the entire year. It was found in the laboratory studies that the preoviposition period of the females averaged about 14 days, and egg-laying averaged about 8 days. E. laingi averaged 150 eggs each, and M. meridionalis averaged 60 eggs each. There appeared to be at least 4 molts during the intermediate stages. This is based on the presence in one specimen of 4 mouthparts, 3 of which were embedded in the cyst wall.

One field control test was conducted in 1956 on E. laingi using VC-13, a nemacide. Post-treatment samples indicated that VC-13 might have a controlling effect. In 1957, a second field test was conducted using the phosphates, malathion, systox and dylox. Analysis of results of these field tests showed that malathion had significantly reduced the populations of these insects. In 1957, greenhouse tests were conducted using the phosphates, malathion, systox and dylox. The results of the greenhouse test, where population numbers were controlled, gave strong evidence that these insects were controlled by both malathion and systox.

Microfilm $2.00; Xerox $4.60. 87 pages.

LIFE CYCLE STUDIES OF RICTULARIA COLORADENSIS HALL 1916 (NEMATODA: THELAZIIDAE)

(L. C. Card No. Mic 59-588)

Leslie Gerard Swartz, Ph.D.
University of Illinois, 1958

The life cycle of Rictularia coloradensis, a spiruroid nematode frequently occurring in Peromyscus Gloger in east-central Illinois, was established and it's morphological development traced in camel crickets and flour beetles.

Ceuthophilus divergens Scudder, Ceuthophilus sp., Udeopsylla robusta (Haldeman), and Tribolium confusum Duval served as intermediate hosts. Eggs hatch in the hindgut and the larvae penetrate the epithelium, undergoing development to the third stage in the epithelium of the gut wall. In Tribolium maintained in constant temperature cabinets at 30° C. and 70% R.H. the first larval molt occurs during the third or fourth day and the second during the eighth or ninth day. The third molt occurs in the definitive host after twelve to forty-eight hours. The fourth molt was not observed but a fully developed male was recovered from Peromyscus leucopus noveboracensis (Fischer) after seventeen days.

Extra-corporeal hatching of the egg was produced by abrasion and it is postulated that normal hatching in the intermediate host is initiated by abrasion of the egg by the masticating structures in the pyloric valve.

The pathology in the intermediate host parallels that reported by Schell (1952) produced by Physaloptera hispida Schell in the German roach, Blattella germanica (Linn.).

A characteristic cyst is formed by host tissue which remains attached to the hindgut in Tribolium and may become detached in camel crickets.

The natural intermediate hosts include Ceuthophilus divergens, Ceuthophilus sp., and Udeopsylla robusta. Naturally infected specimens of Ceuthophilus sp. (nymphs) have been recovered from the wild. Probably other species of these genera can act as intermediate hosts and it is likely, in view of the successful experimental infections of Tribolium, that other arthropods may be found to act as intermediate hosts.

The ecological factors determining the population dynamics of the parasite in the wild are complex, involving not only those which effect the exposed egg stage of the worm (principally temperature and humidity) but those which act indirectly through their effects on the health and abundance of the host animals. Analysis of the resultants of these latter factors in the definitive host, i.e., population fluctuations of Peromyscus, shows a high parasite incidence correlated with long term population increase or relative stability at a high level. Low parasite incidence is correlated with low or widely fluctuating mouse populations. Microfilm $2.00; Xerox $4.40. 82 pages.

SHREDDING BEHAVIOR OF THE WHITE-FOOTED MOUSE, PEROMYSCUS MANICULATUS OSGOODI, WITH SPECIAL REFERENCE TO NEST BUILDING, TEMPERATURE, AND LIGHT

(L. C. Card No. Mic 59-843)

Oakleigh Thorne, II, Ph.D.
University of Colorado, 1958

Supervisor: Assistant Professor Paul W. Winston

Shredding behavior of Peromyscus maniculatus osgoodi Mearns, the white-footed mouse, was studied in the laboratory, using paper towels as the standard material to be shredded. The drive to shred was strong in both sexes when mice were confined in small cages, and increased when animals were deprived of shredding material for a time. Although the behavior is intimately connected with nest building, it is likely that other factors such as cage size, lack of exercise, or lack of other activities are involved in the case of confined mice. Shredding is considered by the author to be a thermoregulatory behavior that can have survival value in the wild at low temperature through its relation to nest building, which provides the mouse with an insulated shelter that conserves body heat.

Temperature and light had marked effects on shredding and nest building when mice were tested in a controlled-temperature chamber. Shredding was reduced at high (33° C.) temperature and nest building was virtually eliminated. At low (8° C.) temperature, shredding was increased and quality of nest building improved. Presence of light reduced the amount of shredding, presumably through reduced activity, and usually lessened the quality of nest building, except at low temperature. Carry-over effect of one extreme temperature upon another was indicated but was not statistically significant.

Young mice with no previous experience in shredding performed the behavior when presented with material. It seems clear, therefore, that shredding is a species-predictable behavior.

Color and taste of paper used, as well as air movement and most sounds, had little or no effect on shredding; but dimensions of the material first presented often affected the rate of shredding, a whole towel being more readily shredded than one cut into narrow strips before presentation.

Shredding is a behavior that can be measured quantitatively with a fair degree of accuracy, and also has great value as an indicator of many behavioral changes. Since each mouse is usually consistent in its manner of shredding under normal conditions, this can be compared with its performance under experimental conditions.

Microfilm $2.00; Xerox $6.00. 123 pages.

BIOLOGY AND CONTROL OF THE SOUTHERN LYCTUS BEETLE, LYCTUS PLANICOLLIS LECONTE, (COLEOPTERA, LYCTIDAE)

(L. C. Card No. Mic 59-338)

Charles Gerald Wright, Ph.D.
North Carolina State College, 1958

Supervisor: Clyde Fuhriman Smith

The biology and laboratory control of the southern lyctus beetle were investigated. Methods were developed for securing numbers of eggs and small larvae, observation of first and second instar larvae and collection of prepupae and pupae in mass. A prepupal stage was reported for the first time.

The influence of two wood species, type of seasoning and the effect of light on the development of this insect over a 38-week period was studied. Red oak and air-dried wood produced more beetles than white oak and heat-dried wood, respectively. The effect of light on adult emergence was inconclusive. The shortest observed duration of time from exposure of uninfested wood to adults to collecting of a newly-emerged male and female was 69 and 68 days in air-dried red oak and heat-dried red oak, respectively.

Measurements, viability, duration of incubation period and visible embryonic development of eggs secured by the "wood shavings technique" were recorded. Observations were made on eggs and larvae on compacted wood flour in small cages. Larval activity and molting were noted. All larvae living in these cages eventually died. The cause of death was unknown. Size measurements, duration and discernible changes of prepupae and pupae and molting of prepupae were noted.

The number of males to females in a stock culture was approximately 50 per cent. Wood shavings provided a satisfactory oviposition site. The duration of the total adult life span, time from exit formation to adult collection, observed life span after emerging from wood, and the deduced time from adult eclosion to formation of an exit were determined. Mating and oviposition habits were divided into the following phases and studied: duration of time between the introduction of a male and a female and their mating, duration of each copulation, number of copulations per hour, duration of time between mating and copulation, length of viable egg deposition, number of viable eggs per female and the act of oviposition.

Complete control of laboratory-induced infestations in half-round and triangular wood samples was secured with soakings of 2 per cent chlordane and 0.5 per cent dieldrin. Wood samples soaked in emulsions of the inert ingredients of the chlordane and dieldrin emulsions produced few adults, while samples soaked in water or left untreated yielded large quantities of adults. A direct correlation between the number of adults collected and the weight loss of the wood was observable. Wood samples containing heavy beetle populations lost more weight than those from which only a small number of adults was collected.

Microfilm $2.00; Xerox $6.00. 121 pages.

STUDY OF IMMUNITY IN THE WHITE RAT TO LARVAL HYDATIGERA TAENIAEFORMIS: EFFECTS OF SPLENECTOMY, ADRENALECTOMY, AND CORTISONE INJECTION

(L. C. Card No. Mic 58-5194)

Kathleen Dee Wyant, Ph.D.
Emory University, 1958

A study was undertaken to investigate further the natural and acquired immunity of rats to infection with larval Hydatigera taeniaeformis, the cat tapeworm, and to determine the mechanisms involved. Host resistance was modified by cortisone injections in non-immune rats, and by adrenalectomy and splenectomy in both immune and non-immune rats.

Cortisone, 2.5 mg daily for five days before and 20 days after infection, did not have an over-all effect on the total number of cysts established (no "early" immunity); however, the larvae apparently migrated faster to the surface of the liver. Cortisone may (1) modify the connective tissue ground substance thereby enhancing activity of the collagenase-like enzyme produced by the larvae during migration and early development, (2) suppress cellular reactions, that would impede the path of the migrating larvae, by (a) interfering with the "early" antibody which is probably elicited by the collagenase-like enzyme, or (b) some other antiphlogistic action. The "early" antigen-antibody combination may normally stimulate the specific cellular reactions against the worms.

Cortisone-treated rats harbored a higher percentage of living cysts (lowered "late" immunity) than the non-treated rats at all the time periods tested. Cortisone may (1) suppress early cellular responses thereby enabling the larvae to reach a more successful stage of development, (2) interfere with the "late" antibody which is probably elicited by the secretions and metabolites of the growing parasites. The "late" antigen-antibody complex may normally stimulate further the cellular reaction, or form precipitates at the surface of the worm thus interfering with passage of materials between the larva and its environment.

Adrenalectomy increased the resistance of the rat to initial infection with H. taeniaeformis larvae. "Early" immune mechanisms induced by artificial immunization prior to adrenalectomy were maintained. The "early" immunities produced by adrenalectomy and immunization were additive. Adrenalectomy may (1) produce an unfavorable physiologic environment for the establishment of larvae by lowering liver glycogen levels, (2) result in an increase in the amount of lymphatic tissue with a subsequent increase in the number and activity of lymphoid cells which are important participants in the cellular phase of immunity.

Adrenalectomy decreased the natural "late" immunity the rat normally develops against the growing larvae. In addition, adrenalectomy following artificial immunization completely inhibited the "late" immune mechanisms normally induced by immunization. Perhaps, the larvae which were able to establish themselves in the "early" unfavorable environment have an inherent ability to continue to withstand such adverse conditions. Adrenalectomy probably inhibits "late" antibody synthesis by a general effect on protein synthesis and cellular multiplication. Inhibitory effects on "early" antibody synthesis were probably not seen because of a time factor in dilution of residual adrenal cortical hormones. It may be that anabolic intermediates for production of antibody and new lymphoid cells were available during the "early" immune response, but were not renewed because of adrenalectomy.

Splenectomy alone had no effect on the degree of infection. There was an interaction between artificial immunization and subsequent splenectomy which created an "early" resistance greater than that obtained by immunization alone. This interaction is explained as follows. Following splenectomy, the remaining lymphoid tissue becomes hyperactive. Since antigen injected intraperitoneally normally localizes in nonsplenic sites, it is possible that a hyperactivity of such lymphoid sites results in an enhanced production of "early" antibodies and/or cellular responses.

Splenectomy increased natural "late" immunity. "Late" immune mechanisms induced by artificial immunization prior to splenectomy were maintained. The increased "late" immunity produced by splenectomy and the "late" immunity produced by immunization were additive. This is probably also explainable on the basis of hyperactive lymphoid tissue. This would mean that, basically, resistance to H. taeniaeformis is a lymphocytic resistance.

Rats with a pre-existing respiratory infection did not respond to artificial immunization. The lymphatic system may have been in a refractive state with regard to responding to immunization, as a result of trying to combat the respiratory infection. Splenectomy prior to immunization in such rats had no effect in either immunized or non-immunized rats.

Cortisone treatment did not break down the almost complete "early" immune mechanism acquired by an accidentally acquired active infection. The infection was probably acquired about two weeks before cortisone treatment was begun, by which time the immune mechanisms should have been well established.

The above mechanisms which have been postulated to explain the results obtained in this investigation on H. taeniaeformis are consistent with the following hypotheses proposed by investigators of nematodes. The protective immunity against infection may be an enzyme-antienzyme mechanism in which the enzymes used by the larvae for invasion and nutrition serve as antigens. The reaction products of the specific antibodies may normally serve as a stimulus in arousing the specific reactions in the rat against the larvae. The immunity mechanisms are probably due to the primary action of specific antibodies with secondary cellular cooperation, with the cellular factor being of greater importance in bringing about the actual expression of the immune response. Variations in the activity of the lymphatic system directly affect the immune response.

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